GEOGRAPHICAL PATHOLOGY.

GEOGRAPHICAL PATHOLOGY:

AN INQUIRY INTO THE GEOGRAPHICAL DISTRIBUTION OF INFECTIVE AND CLIMATIC DISEASES.

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INTRODUCTION.

THE object of this work is to sketch the geographical distribution of infective and climatic diseases, and to trace the influence of temperature, rainfall, altitude, and soil-conditions on their prevalence, character, and epidemic spread.

Under the term infective diseases, I include miasmatic diseases, such as malaria; miasmatic-contagious maladies, such as cholera; and the contagious diseases proper, such as scarlet fever.[1] Climatic diseases include, amongst others, croup, bronchitis, pneumonia, and rheumatism, which are either owing to, or are materially influenced by, meteorological conditions.

Organic diseases of the heart, kidneys, and nervous system, which are not, as a rule, caused by infection, and are not materially

[1] It seems to be necessary to define more precisely the sense in which I employ these terms:—

The terms *miasm* and *malaria* are not used in their etymological significance. By miasm is to be understood an infectious principle, whether organised or toxic in its nature, developing in, and derived from, the soil or other local surroundings of man,—even although the disease caused by such infectious principle may be communicable from man to man by inoculation. Recent experiments seem to show that malarial fever is capable of being thus communicated, but it is not the less a miasmatic disease in the sense which we have defined.

By malaria, I mean the hitherto undiscovered cause of intermittent fever and of the other forms of fever and constitutional disturbance due to the same infection. Malaria is a typical miasmatic disease; but there are other miasms besides malaria, and miasmatic fevers other than those of malarious origin.

A miasmatic-contagious disease is one due to an infectious principle which is derived from the body of a person or animal suffering from it, but which is capable, not only of maintaining itself for a time, but also of developing or multiplying in the soil, water, food, or other substrata. This does not exclude the possibility of the more or less direct transference of the infective principle from the sick to the healthy.

The infective agents of the class of true contagious diseases may adhere to clothes, walls, furniture, soil, or articles of food, but are not supposed to undergo any change, or even to multiply outside the body. It may, however, be ultimately proved that some of those diseases, which are at present regarded as contagious, are really miasmatic-contagious maladies.

influenced by soil and climate, do not come within the scope of this work, and consequently are noticed only when their exceptional prevalence in a particular country or locality appears to be the result of infective processes, or of climate; as, for example, in the instance of British Guiana, where the altogether unusual prevalence of chronic kidney disease is supposed to be the result of the malarial infection.

Endemic malarial fever, in its various forms and types, and the extent to which its prevalence and type is affected by temperature, rainfall, inundations, marshes, subsoil humidity, disturbance of the soil, and other circumstances, has been treated in detail in connection with the pathology of Italy, Algeria, India, Africa, the United States, and other malarious countries. Charts illustrating the characters which malarial fevers assume in different countries have been introduced.

Epidemic malaria has also received considerable attention. The history of particular epidemic outbreaks in Cyprus, India, Java, Madagascar, Mauritius, the United States, and Brazil, have been narrated somewhat fully.

Rock fever, mountain fever, river fever, and other anomalous forms of pyrexia, have been described under the pathology of the countries in which they occur.

Typhoid fever, in its miasmatic and miasmatic-contagious forms, as seen in Europe, India, the Cape, the United States, and Brazil, has received special attention. The principal facts relating to cholera are considered in connection with its occurrence in India, and those relating to yellow fever under Cuba. The forms assumed by syphilis in certain countries have been described in the concluding chapter. The distribution of pneumonia and phthisis has been investigated, with reference to their causation, in the chapter on the United States, and that of dysentery under East Africa. The various forms of influenza—their relation to one another, and the chief features of the epidemic disease, have been discussed in the chapter treating of the pathology of Brazil. A short account of the principal maladies of the aborigines of Australia, the Maories, the now extinct Tasmanians, and the American Indians, has been added to the chapters on the pathology of their respective countries.

The primary point in the study of the geographical distribution of diseases is to ascertain their prevalence—actual or relative—in the different areas which come under review. To determine the actual prevalence of any given disease over an extensive area, with any approach to scientific accuracy, is obviously, under present conditions, impossible. The utmost that can be attained is an

approximate estimate of the relative prevalence of diseases in different countries. Fortunately such a knowledge as is attainable in regard to most countries is not only full of interest to the student, but of vast practical importance to the statesman, the army medical officer, and the sanitarian.

The means of ascertaining the prevalence of diseases in a given country or district are direct or indirect. The direct method, which gives the number of cases of each of the more important maladies occurring monthly and yearly within a given area, is undoubtedly the best. In Sweden and Norway, the cases of disease which come under the cognisance of the district medical officers are regularly reported to the State authorities, who publish annual reports, from which the varying frequency of each disease in different localities and seasons can be readily ascertained. This method has the great advantage of enabling us to judge of the prevalence and distribution of those diseases which are seldom fatal.

The indirect methods of arriving at a knowledge of the relative prevalence of diseases in different countries are—1. The proportion of deaths from a given disease to a unit of the population. 2. The proportion of deaths from a given disease to the deaths from all causes within a certain area. 3. The ratio which each disease bears to the total treated in hospitals. 4. The reports of physicians who have resided in, or of travellers who have visited, the less civilised countries, as to the diseases they have observed to prevail amongst the natives.

The first of these indirect methods appears to me to be the best, wherever the registration of the medically certified causes of death is efficiently carried out, and when the population is accurately known; and it has been this basis for estimating the fatality, and, indirectly, the prevalence of disease, that I have adopted wherever it has been possible to do so. Many authorities, however, consider that the proportion which the deaths from a given disease bears to the total mortality furnishes the most reliable measure for estimating its frequency. In all cases it is desirable to replace vague expressions, such as "rare," "common," and "very common," by numerical ratios; but it is no less true that a general statement by a physician who has resided for some years in a country, and who has had adequate opportunities for observing the prevailing diseases, will often give a more faithful idea of the pathology of a country than that which is derived from loosely-collected statistical data. As we are most familiar with the frequency and fatality of diseases in England, I have, in many instances, given the mortality of diseases in England

as a measure of comparison while treating of the pathology of other countries.

All the methods which we have enumerated for determining the prevalence of diseases in different countries, impose upon us a politico-geographical treatment of the subject; for it is only for political divisions that we have the necessary basis of population and tables of mortality.

Some writers on the geographical distribution of diseases have described the pathology of the various regions according to climates defined by isothermal lines, such as the polar, cold, temperate, warm, and torrid climatic zones. Although this arrangement looks well, it has the great practical disadvantage of cutting up States, such as Norway, into two divisions, which have to be considered separately, and without regard to the civil divisions for which alone all returns are made.

I have preferred to accept the usual division of the world into continents, and the continents into the existing kingdoms and States; and then by the grouping of the States into divisions, from north to south, the different climates come into consideration pretty much in their natural order.

The sources from which I have drawn my information have been the official returns of the statistical departments wherever these have been attainable. These returns have formed the basis of the accounts given of the pathology of Norway, Sweden, Germany, Austria, Switzerland, Holland, the British Isles, France, Spain, Italy, India, the British Colonies generally, and the United States.

For the Indian Archipelago, Senegal, and Tonkin, I have had to depend, to a large extent, on the admirable reports appearing from time to time in the pages of the *Archives de médicine navale.* For Borneo, Singapore, Ceylon, Cyprus, Persia, Gibraltar, the West Coast of Africa, the Congo Free State, and some other places, I have been favoured with special reports by the medical authorities, or by medical men on the spot. The information obtained from these sources has been supplemented by that derived from medical periodicals and publications.

The frequent references made to the works of Hirsch and Lombard show, although inadequately, to what extent I have availed myself of their labours. The *Handbuch der historisch-geographischen Pathologie* is a monument of scholarly research, to which every student is indebted. From this the dates of outbreak, and the progress of the epidemics of cholera and influenza in Europe, and the distribution of goitre and leprosy generally, have been mainly derived. Lombard's great work, *Traité de Climatologie*

Médicale, has been specially consulted in reference to the pathology of Switzerland, France, and Russia.

No one can be more sensible than I am how incomplete are the accounts I have been able to furnish of the pathology of several important regions. In respect to some of these, the data for a fuller treatment of the subject are absolutely wanting; in other instances, documents doubtless exist, to which I have not had access, which would have enabled me to fill up many of the existing gaps in the information I have been able to give. Errors, too, notwithstanding all the care I have taken to avoid them, must have crept into a work which presents such a mass of statistics; but I am sanguine enough to hope that these are neither numerous nor important.

LONDON, *January* 1892.

GEOGRAPHICAL PATHOLOGY.

EUROPE.

DIVISION I.

NORTHERN EUROPE.

GEOGRAPHICAL PATHOLOGY.

CHAPTER I.

ICELAND AND THE FARÖE ISLANDS.

GEOGRAPHY. — Iceland is situated in the North Atlantic Ocean, between 63° 23′ and 66° 33′ N. lat., and between 13° 22′ and 24° 15′ W. long. Its area is estimated at 39,207 square miles, with a population, in 1888, of 69,224.

The coasts are intersected by numerous firths or fiords. The interior consists of a table-land, having an average height of 2000 feet, sloping down towards the north and south. This table-land is covered with sand and lava, broken by high and extensive ice-hills, known as jökull, which attain their highest elevation in the south-east, where the great Vatna Jökull ice-field is estimated to cover an area of 4000 square miles. The highest peak in the island, the Oeräfa Jökull, attains an elevation of 6466 feet. Numerous active volcanoes and hot springs or geysers are scattered over the central area. The largest lake, only recently discovered by Thoroddsen, named Langisjör, 30 to 40 miles in length, lies in the south-eastern part of the island.

The most extensive plain is that which stretches westward from the Eyafjalla Jökull to the mountain chain terminating in the Cape of Reykjanes, and backed on the north by several isolated mountains, amongst which stands out in bold relief the snow-clad peak of Hecla, which rises to a height of 5102 feet above the sea-level. This plain is covered with rich grass, and, like many of the smaller plains and valleys, it contains extensive marshes.

The country is entirely pastoral. Only a few level tracts along the shore and in the more sheltered valleys are capable of cultivation. The whole cultivated area does not, in fact, exceed 300 acres.

The grass lands of the coasts and plains support some 30,000 horses, 20,000 head of oxen, and above half a million of sheep, upon which, and on their fisheries, the inhabitants entirely depend. The population live on isolated farms; the villages are few, and the capital, Reykjavík, has only a population of from 3000 to 4000 souls. Its site is low, surrounded by hills, with a lake to the south, which occasions unhealthy emanations.

CLIMATOLOGY.—The climate of Iceland is less severe than might be expected from the high latitude of the island. The winters are long, but in the south they are comparatively mild. The summer heat, however, is insufficient to ripen cereals. The atmosphere is clear and pure, mountains being visible at a distance of 100 miles. The mean annual temperature of Reykjavík is 39°·2 F.; that of Akureyri, in the north, is 32° F.; but the mean temperature of different years, and of individual months, varies considerably.

The average rainfall of Reykjavík (including snow) is about 29 inches, the heaviest rains falling in autumn and winter. The monthly distribution per cent. of the rainfall, and the mean monthly temperature at the capital, are as follows:—

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Monthly percentage of rainfall,	10	10	9	6	6	5	7	7	9	11	9	11
Monthly mean temperature,	29·8	28·4	30·0	36·5	45·0	51·8	56·2	51·0	46·6	36·8	30·5	28·0

Small as Iceland is, an exceptional interest attaches to its pathology. From its position on the confines of the Arctic Circle, it affords an illustration of the diseases prevailing in high latitudes. Its remoteness and limited intercourse with the outer world enable us to trace the introduction and progress of epidemic diseases more closely than is possible in the case of countries less isolated; while the records of epidemic diseases in the past have been more carefully preserved than in many countries in Western and Southern Europe.

VITAL STATISTICS.—The birth-rate of Iceland in recent years is given at 33 per 1000, and the death-rate at 24 per 1000. The proportion of deaths varies greatly in different years, according to the presence or absence of epidemic disorders. Thus, during the ten years 1854–63, the mean death-rate was 32·8 per 1000, the lowest being 23 per 1000 in 1856, and the highest 50 per 1000 in 1860. The deaths under one year were in the ratio of 27·3 per cent. of the births.

A remarkable feature in the pathology of Iceland, as pointed out by Lombard, is the peculiar seasonal distribution of the mortality

Unlike most cold countries, in which the greatest mortality occurs during the cold season, in Iceland it is the autumn season in which the deaths are in excess. The following is the distribution per cent. of the deaths for the four seasons (1845–54) :—

Spring.	Summer.	Autumn.	Winter.
20·24	19·38	33·31	27·07

PATHOLOGY.—*Malaria.*—Paroxysmal fevers are not endemic in Iceland. Torteinson never met with any, except in the case of foreign sailors or travellers. The numerous marshes which are met with throughout the inhabited districts are either naturally innocuous, or, as is more probable, they fail to develop fever on account of the low mean summer temperature, which at Reykjavík does not, on an average, exceed 53° F. Although the marshes of Iceland do not give rise to paroxysmal fever, Hjaltelin is of opinion that they adversely affect the health of the population ; those districts, such as Pingvalla, where there are no bogs, being notably healthier than those where opposite conditions prevail.[1]

Enteric Fever, known as *Landfarsot*, is endemic in Iceland ; and it not unfrequently assumes an epidemic form. A mixed outbreak of typhoid and typhus fevers devastated the island from 1857 to 1860. An epidemy of typhoid fever occurred in 1871, causing a considerable mortality. This outbreak began in the middle of July, during an unusually hot, dry, and calm summer ; the temperature of the summer having been about 8° F. above the average. "Carbuncle-like, black-crusted boils" were observed in some of the cases during this epidemy.[2]

Typhus Fever, as we have seen, occurs in an epidemic form. These epidemies are by no means of rare occurrence, but whether the disease is endemic in the island, or is introduced from without on each occasion, is unknown. *Plague* in former times was no stranger in Iceland. The date of the first outbreak was 1402.

Relapsing Fever has never been observed in Iceland, and *Epidemic Cerebro-spinal Meningitis* broke out only once, viz. in the winter of 1846.

Diphtheria appeared for the first time in Iceland in 1856, breaking out in Reykjavík and the surrounding parishes, where the infection maintained itself during the succeeding year. In 1858, the disease began to spread to the northern and western parts of the country. It then appears to have died out ; but it was intro-

[1] Hjaltelin, *Edin. Med. Journal*, May 1866.

[2] Hjaltelin, "Pythogenic Fever," *Edin. Med. Journal*, February 1872.

duced anew in 1860, and continued to maintain itself until 1864. If we consider that the disease appeared at Reykjavík, which is practically the only spot in communication with Europe, and that it occurred at a time when the disease was not only widely diffused throughout Scandinavia, but when it was exhibiting a tendency to epidemic extension, it will appear probable that it was introduced from the continent of Europe. The second outbreak, in 1860, is supposed to have been caused by a reintroduction of the infection from the Faröe Islands.

Croup, according to all accounts, is of common occurrence in Iceland. Acute affections of the throat, including croup, account for 32 per 1000 of the total mortality. Allowing that this figure includes deaths from diphtheria as well as croup, it is evident that anginal affections are of exceptional gravity in Iceland. In 1884, diphtheria, croup, laryngitis, and other diseases of the larynx and trachea, caused 21·9 per 1000 of the deaths from all causes in England. It will thus be seen that this class of diseases is much more fatal in Iceland than in England.

Asiatic Cholera.—Hjaltelin, in treating of the epidemic fever of 1860, says: "Asiatic cholera made its appearance, but happily it was sporadic, and did not spread by contagion."[1] As cholera was at that time prevalent in the Baltic provinces of Russia and in other parts of Northern Europe, and had been epidemic during the previous year to a small extent at one point in Denmark (Aarhus), a country which is in constant communication with Iceland, and as a limited epidemy had broken out in 1859 as far north as Wick in Scotland, we cannot summarily reject as impossible the opinion of Hjaltelin, that the cases observed by him in Reykjavík were really cases of Asiatic cholera. On the other hand, its occurrence in a sporadic form only, its limited spread, and the small mortality it occasioned, incline us to the opinion that the outbreak observed by this physician was caused by cholera nostras, rather than to an importation of the Asiatic pestilence.

Dysentery is occasionally met with in a sporadic form, but such cases are, upon the whole, rare, and of no great gravity. The ratio of deaths to the cases treated by Finsen was 6·7 per cent. As an epidemic malady, dysentery plays a somewhat more important *rôle* in the pathology of Iceland. Epidemic outbreaks of this disease were more numerous in past centuries than they are at the present day, and were in many instances to be ascribed to famine, or to the use of food of bad quality. Malignant dysentery prevailed in an epidemic form in 1860 along with typhus. These two diseases

[1] *Edin. Med. Journal*, September 1862.

have been frequently observed as associated epidemies, especially in times of famine, as, for example, in Ireland in 1817, and again in 1824–26. Scarcity, however, was not the underlying cause of their simultaneous outbreak in Iceland in 1860. In 1855 a limited outbreak was observed "in consequence of the use of bad food, but disappeared when a better quality was brought in" (Hirsch).

Diarrhœa is comparatively rare in Iceland, a fact which may be explained by the low summer temperature of the island. Apart from the epidemic outbreaks of dysentery to which we have referred, abdominal diseases, as a class, are not prevalent in the island, forming, according to Schleisner, no more than 12 per 1000 of the total deaths.

Influenza.—It is doubtful whether true influenza ever occurs in localised and independent epidemies, or whether each outbreak in any particular country or locality is not due to an extension to that locality of an epidemic influence affecting large tracts of the earth's surface. In Iceland, epidemic catarrhs are certainly not uncommon; and it is difficult, in many instances, to distinguish between the local influenzoid outbreaks and the extension to Iceland of epidemic or pandemic influenzas prevailing in Europe or America. These local epidemic catarrhs, so frequent not only in Iceland, but in Greenland and other hyperborean regions, have been regarded by some as identical with influenza; by others, as a specific affection closely allied to that disease, and distinguished as *influenza arctica;* while others, again, look upon them as outbreaks of simple catarrh arising from the climatic conditions peculiar to cold regions, and owing their epidemic prevalence at certain seasons to meteorological causes.

It would be foreign to my purpose to enter into any discussion of these questions, which, however, should be kept in view in considering the facts relating to influenza and allied disorders as met with in Iceland and elsewhere.

The earlier epidemies of influenza recorded by Hjaltelin[1] as occurring in Iceland are those of 1627, 1669, 1705, 1719, 1730, 1735, 1736, and 1776. Of these, the first and the four last were coincident with epidemies of influenza in Europe or America, while those of 1669, 1705, and 1719 were, so far as can be ascertained, of local origin. As regards the outbreak of 1719, it is stated to have been confined to the north of the island, and may thus be regarded as one of epidemic catarrh.

During the present century, the epidemies up to 1866 occurred in the following years:—1804, 1816, 1825, 1834, 1839, 1843,

[1] *Edin. Med. Journal*, February 1863.

1855, 1856, 1862, and 1866. Most of these coincided with, or followed closely in the wake of, extensive epidemies of influenza in Northern Europe or in North America. The epidemy of 1804 followed closely on an outbreak in Northern Europe; those of 1816 and 1825 accompanied or followed the epidemic prevalence of influenza in North America; that of 1843 appeared in Iceland at the time it was prevalent both in Northern Europe and in North America; and that of 1855 coincided with a wide diffusion of the disease in Northern Europe.

Some, if not all, of the other outbreaks may also have been extensions to Iceland of pandemies previously prevailing elsewhere, although their connection in point of time is not so close.

The great pandemy of 1831–33 had run its course, and had pretty well died out in the north of Europe, by the middle of 1833, although it still lingered on to the end of the year in the south of Europe. In 1834, when Iceland was attacked, Europe and North America were alike free from the disease. In 1838 or 1839—for the date is variously given, and perhaps both years suffered—the epidemy of 1836–37 had come to an end. The Faröe Islands had been invaded in 1837, without the extension of the disease to Iceland. In 1838, when the disease appears to have broken out in Iceland, influenza had been absent from Europe for about twelve months. In 1856, 1862, and 1866, influenza was not at all widely diffused either in Europe or in America; and some of these outbreaks may have been of local origin.

From what we have said, it would appear that Iceland may be invaded either during the prevalence of epidemic influenza in Europe, or at the close of such epidemy; or, on the other hand, that quite a year or more may elapse after the disease has disappeared from the continent of Europe before Iceland is invaded. Some epidemies in Iceland cannot be connected with general outbreaks, while a considerable number of severe and widely diffused epidemies affecting Europe, such as those of 1846–48, never reach Iceland.

Epidemies of influenza proper have frequently been observed to start from Reykjavík, as was the case in 1862, taking from six weeks to two months to overrun the whole island. The general rule is, that epidemies proceed from south to north; but to this rule there are exceptions. In 1856 the epidemy took an opposite course, advancing from north to south; but it is doubtful whether this was true influenza, or an outbreak of epidemic catarrh.

Influenza has often been observed to make its appearance immediately after the arrival of a foreign vessel, although the passengers and crew of such vessel may not have been suffering from the

disease, and although influenza may not have been raging in the port or country from which it sailed.

This remarkable coincidence, so often noticed and so well attested, between the arrival of foreign vessels free from the disease and outbreaks of influenza and influenzoid diseases, has also been observed in other countries, such as the Faröe Islands, St. Kilda, and in some of the South Sea Islands; while in Brazil, a fatal disease allied to influenza has repeatedly caused destruction to Indian tribes, who ascribe its appearance amongst them to intercourse with strangers who are not themselves affected.

The outbreak of influenza in Iceland on the arrival of foreign vessels can only be explained on the assumption that the specific cause of the disease is transportable; but it does not follow that commercial intercourse is the only means by which the malady is diffused.

Another remarkable circumstance in connection with the outbreaks of influenza in Iceland, is the immunity from the disease enjoyed by strangers and recent arrivals, while very few of the natives escape taking the disease.

The mortality varies greatly in different epidemies. The outbreak of 1855 was mild, while that of 1862 was one of the most malignant that had ever visited the island. It has been remarked that those outbreaks that coincide with epidemies on the Continent are more malignant than those that are of local origin.

Highly characteristic of this disease is the suddenness with which it attacks large numbers of people at the same time. This was well seen in the case of the epidemy of 1862 in Iceland. On the 10th of May, which was a Saturday, an unusual mist settled down on the town of Reykjavík, but there was then no sign of the disease. On the following day (Sunday), the disease had already affected many of the inhabitants. Hjaltelin quaintly remarks that the worshippers "made a very bad noise during the holy service." On Monday large numbers were confined to bed.

Whooping Cough is not endemic in Iceland, and, what is still more remarkable, it has never been observed to spread even when introduced into the country.

Smallpox was introduced into Iceland from Denmark, for the first time, in 1306, and all the later outbreaks of the disease, which before the introduction of vaccination were both numerous and severe, were traced to fresh importations from the Continent. At the present day the disease is seldom seen. This immunity is partly owing to the efficiency with which vaccination is carried out, and partly to the prompt isolation of any case that occurs.

Measles have only appeared four times in the history of Iceland, viz. in 1664, 1694, 1846, and 1868, and on each occasion it has been traced to importation.

Scarlet Fever only occurs at rare intervals, when introduced from without. It will thus be seen that none of the eruptive fevers are endemic in the island.

Pneumonia, Pleurisy, and *Bronchitis,* as sporadic diseases, are not of more frequent occurrence in Iceland than in many countries in the south of Europe. *Phthisis* is seldom met with in those born in the island.

Epidemic Pneumonia, known in Iceland as *Taksott,* is by no means uncommon. It generally occurs during severe winters and cold springs. In the winter of 1862, pneumonia assumed an epidemic character in the north of the island; and, following upon the outbreak of influenza which had prevailed in the summer, it caused a high mortality. In some parishes the deaths from this disease were in the proportion of 15 per 1000 of the population.[1]

Hepatitis is rarely seen in Iceland.

Hydatid disease of the liver, due to the introduction into the system of the eggs of the Tænia Echinococcus infesting the dog, is endemic in the island. The proportion of the population infested by this parasite has been variously reckoned as from one-seventh to one-thirtieth. Taking even the lowest estimate, it will be seen that the disease is excessively prevalent. As this parasite runs through its stages of development alternately in the sheep and dog, there is no difficulty in understanding the reason of its prevalence. Sheep, as we have seen, are reared to a large extent in the island, and dogs, according to Lombard, are in the proportion of one to three or five of the inhabitants; while in France there is one dog to twenty-two, and in England one to fifty of the population.

Females suffer from hydatids to a much greater degree than males.

Diseases of the Spleen are not of frequent occurrence in Iceland.

Trismus Neonatorum was excessively frequent during the earlier decades of this century, when it was estimated to cause from one-third to one-fourth of the total mortality. With improved hygiene, the prevalence of the disease has steadily diminished in Iceland, although it is still common on some of the smaller islands off the coast.

Cancer, although not unknown, is much less frequent in Iceland than on the continent of Europe generally. The deaths caused by

[1] *Edin. Med. Journal,* April 1864.

cancer are estimated by Hirsch to be in the proportion of 0·07 per 10,000 living.

Rheumatic affections are amongst the more common diseases of the island, and *Rheumatic Fever* is far from rare.

Scrofula, so far as can be gathered from the conflicting reports of different authors, is of moderately frequent occurrence.

Syphilis is excessively rare and of a mild type. This is to be ascribed to the orderly and moral lives of the Icelanders, rather than to any peculiarity of climate.

Leprosy was formerly very widely diffused throughout the population, but it has been gradually and steadily diminishing in frequency since the middle of the last century. In 1768 the proportion of lepers was estimated at 73 per 10,000; in 1838 the ratio had fallen to 23·3; and in 1869 it stood at 15·7 per 10,000 of the inhabitants.

THE FARÖE GROUP.

Geography.—The Faröe or "Sheep Islands," twenty-two in number, of which seventeen are inhabited, lie between 61° 25′ and 62° 25′ N. lat. Their population in 1880 was 11,220. They consist of volcanic rocks, mainly basalt, forming precipitous cliffs towards the sea, from 1000 to 2300 feet in height, rising inland into flat-topped mountains, which attain a maximum elevation of 2900 feet in Slattaretind in Österö.

The most important island of the group is Strömö, on which is situated the capital, Thorshaven, with a population of 984. The islands of Österö, Vaagö, and Sandö are grouped closely round the main island, while the island of Suderö lies isolated at a distance of 12 or 13 miles to the south of the others.

Climatology.—The mean annual temperature is 45°·5 F.; that of spring, 44°·2 F.; of summer, 54° F.; of autumn, 46°·8 F.; and of winter, 40°·1 F. July, the warmest month, has a temperature of 57°·1 F. The temperature is thus mild and equable, but the climate is humid, misty, and rainy. The number of rainy days, on an average, is 160.

Pathology.—*Malaria.*—Paroxysmal fevers are quite unknown in this group. *Enteric Fever* is endemic, and occasionally becomes epidemic, causing a considerable number of deaths. *Typhus* has never been met with in this group; nor does it appear that *Relapsing Fever* or *Epidemic Cerebro-spinal Meningitis* has been observed. *Erysipelas* occurs not unfrequently in an epidemic form in the Faröe Islands, as it does in many northern countries.

Diphtheria appeared in these islands for the first time, so far as is known, in 1860; but I have met with no later accounts of its presence in the group. *Croup* is said to be of rare occurrence.

Asiatic Cholera has never reached the Faröe Islands. *Dysentery* is not endemic, but sporadic cases occasionally occur. *Diarrhœa* is of moderate frequency, and cases of *Cholera Nostras* are met with in the summer season.

Smallpox has been only twice observed in these islands—first in 1651, and again in 1705. On both occasions it was introduced from Denmark, and in each case it proved very destructive.

Measles are not endemic in the Faröe group, where, up to the present time, they have only been four times observed, viz. in 1781, 1846, 1862, and finally in 1875. On all of these occasions the disease was traced to importation.

Scarlet Fever has apparently never appeared in these islands. We may conclude, therefore, that none of the eruptive fevers are endemic in the Faröe Islands, which are thus free from a whole class of diseases that prove very destructive to infant life over wide regions of the globe.

Influenza.—The Faröe Islands not only frequently suffer from influenza when it is raging on the Continent, but local influenzoid epidemies are of frequent occurrence in spring and summer. According to Panum,[1] these outbreaks occur in the spring of the year, two or three days after the arrival of the first trading vessel from Denmark. The first to be affected are the men from the shore whose duty takes them on board; the disease then spreads in the town of Thorshaven, and thence over the island of Strömö. The island of Suderö, which is situated at a distance from the rest of the group, often escapes the malady when the other islands close to Strömö are affected. The strangers themselves, who are supposed to bring the disease, are not attacked during these epidemies. That the outbreak does not simply coincide with the arrival of a vessel from abroad, is shown by the fact that the arrival of the first trading vessel happens at various times, sometimes as early as March, at other times as late as May; but the disease breaks out with great uniformity just after its arrival, whatever may be the date. Whether the cause of the disease attaches itself to the persons on board, or to the vessel itself and its cargo, it is impossible to say, but it seems clear that the cause of these epidemies is brought to the islands by the vessels. This would not be at all so remarkable, were it not for the fact that neither the men on board the ship nor the inhabitants of the port from which it sailed exhibit any signs of the disease.

[1] *Biblioth. für Læger*, 1847, v. i. 312, quoted by Hirsch.

Pneumonia is only moderately prevalent, and *Bronchitis*, as a sporadic disease, although of common occurrence, is not marked by any special severity. *Phthisis* is extremely rare.

Hydatids, so prevalent in Iceland, are not met with in the Faröe Islands. The hosts (sheep and dogs) are there in ample numbers, but the guest, the Tænia Echinococcus, is wanting.

Diseases of the *liver* and *spleen* are rare. *Trismus Neonatorum* is not of frequent occurrence. *Cancer* seems to be quite unknown in the group. Panum saw no case of it during his residence in these islands, nor could he hear of any. Here, then, we have a country from which this terrible scourge of humanity is absent.

Rheumatism and *Rheumatic Fever* are of frequent occurrence.

Scrofula is scarcely ever seen among the natives, although it is occasionally observed amongst the children of Danish residents. *Chlorosis* is rather common. *Syphilis* is said by Panum to have been quite unknown in the Faröe Islands until the year 1844; but this is, at least, doubtful, as Manicus, in 1824,[1] appears to have met with the disease in its different forms. At the present day it is certainly very seldom seen.

Leprosy died out in this group in the middle of the eighteenth century.

Hysterical diseases and *Insanity* appear to be unusually common among the islanders.

[1] *Biblioth. für Læger*, 1824, v. i.

CHAPTER II.

NORWAY.

GEOGRAPHY.—Norway, which forms the western division of the Scandinavian peninsula, stretches from 57° 58′ to 71° 10′ N. lat. It has an area of 120,079 square miles, with a population (in 1887) of 1,967,000 inhabitants. It is washed on the north by the Arctic Ocean; on the west by the Atlantic; on the south by the Skager-rack, and is divided from Sweden on the east by the lofty ranges of the Kiolen Mountains and their southern prolongations.

The coast-line is fringed with islands, and is deeply indented with fiords. The Hardanger Fiord runs nearly a hundred miles inland, sending out numerous arms to the right and left. The interior is mountainous, the wider valleys and plains of the south being the only districts capable of cultivation. The country is watered by numerous rivers, the most important of which is the Glommen, which falls into Christiania Fiord, and has a length of 350 miles, draining a basin of 6657 square miles. The lakes are very numerous, but none of them are of any great size; the largest being the Mjösen, situated to the north of Christiania. A very considerable area is still covered with swamps and morasses; but much has been done of late years for the reclaiming of marsh lands.

The capital is Christiania, with a population (in 1887) of 133,300 inhabitants. Bergen, on the west coast, is the second city of the kingdom, with a population of 47,000 inhabitants. The only other towns of importance are Trondhjem (Drontheim), the ancient capital (pop. 23,753); Stavanger (pop. 22,634), and Drammen (pop. 19,391). The people are chiefly engaged in agriculture and fishing. The bulk of the inhabitants are thus to be found in the rural districts. The population of the towns and villages numbered (in 1887) 435,700, while that of the country districts was 1,531,300. The open-air occupations of the inhabitants tell favourably upon the health of the country.

The country is divided into six "stifts" or diocesal provinces, and these again into "amts" or counties, twenty in number.

The following are the "stifts" and their population in 1887:—

Christiania, . . .	555,100	Bergen, ...	310,600
Hamar, ...	227,100	Trondhjem, . . .	283,500
Christiansand, . .	366,500	Tromsö, ...	224,400

Climatology.—The temperature of Norway is materially affected by the extent to which the Gulf Stream makes its influence felt. This will be seen by the subjoined table, which gives the mean temperature of the seasons in five localities representing the west coast-line in three parallels, and the south-east region as represented by the capital:—

Temperature of the Seasons in Different Regions of Norway.

Locality.	Spring.	Summer.	Autumn.	Winter.	Mean of Year.
	°	°	°	°	
North Cape, lat. 71° 10′, . .	29·5	43·5	31·5	23·5	32·0
Drontheim, lat. 65° 26′, . .	35·2	61·0	40·22	23·0	39·85
Bergen, lat. 60° 24′, . . .	44·7	59·0	46·4	36·0	46·5
Christiania, lat. 59° 55′, . .	38·5	60·5	42·0	25·5	41·6

Christiania, although situated so much to the south of Bergen, has a lower mean annual temperature, on account of the latter being more directly under the influence of the Gulf Stream. The winter season especially is much colder in Christiania than in districts situated considerably farther north. There are, indeed, only two degrees of difference between the winter temperature of Christiania and that of North Cape, lying within the Arctic Circle. The climate of the inland and elevated districts is much more extreme than that along the coasts. But other conditions, dependent on latitude, very materially influence the climate. The northern winter is characterised by its long night, and the northern summer by its unsetting sun. The longest day in the south is about eighteen hours; in the extreme north it is nearly three months; the winter night within the Arctic Circle lasts about the same length of time.

The annual rainfall along the west coast is heavy; at Bergen it averages from 80 to 90 inches, but this is one of the wettest districts of the country. The average precipitation along the west coast, between parallels 58° to 69°, may be placed at 45 inches; on the east coast and inland it is less than half of this amount. The following, according to Hann,[1] is the monthly distribution per cent. of the rainfall for the east and west coasts:—

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
West Coast, 58°–69°,	9	8	7	6	5	6	7	8	12	12	10	10
East Coast and inland, 59°–63°, .	7	8	6	4	6	9	12	11	12	10	8	7

[1] Hann, *Handbuch der Klimatologie*, Stuttgart 1883.

VITAL STATISTICS.—No country can show a better record than Norway in respect to health. The death-rate for the sixteen years ending 1866 was only 16·8. In 1887 the death-rate for the kingdom was 16·10 per 1000; in the town districts it was 19·27, and in the country it was as low as 15·20 per 1000. The mean annual death-rate of Christiania (1880–87) was 19·9 per 1000. The death-rate does not increase as we advance towards the north. On the contrary, we find that the most northerly province, Tromsö, has a lower mortality than that of the two southern provinces of Christiania and Christiansand; while the inland province of Hamar, with its rigorous climate, has the lowest death-rate of any part of the kingdom. The following table gives the average death-rate of the six "stifts" for the three years 1885–87:—

Christiania,	18·0	Bergen,	15·3
Hamar,	14·58	Trondhjem,	15·45
Christiansand,	16·6	Tromsö,	15·4

The quarterly distribution per cent. of the mortality is thus given by Lombard:[1]—

Spring.	Summer.	Autumn.	Winter.
28·79	21·88	22·33	27·0

The marriage-rate for the sixteen years ending 1886 was 14·01; the birth-rate for the same period, 30·8. It will thus be seen that the increase of the population in Norway is rapid, or would be so, were it not for the emigration which relieves the country of its surplus population.

PATHOLOGY.—*Malarial Fever* is unknown in the northern part of Norway; the cases occasionally observed in Bergen and to the north are probably imported. The number of cases reported in 1886 was 109, and in 1887 there were 93. In the latter year there were no deaths from ague. The number of cases reported from each province in 1887 was as follows:—

Christiania,	37	Bergen,	3
Hamar,	6	Trondhjem,	3
Christiansand,	43	Tromsö,	1

It is only in a few marshy districts in the south of the country, such as Sarpsborg, in Smaalenes Amt; Tönsberg, in Jarlsberg; and East and West Nedenæs, that the disease can be said to be endemic; and in these localities the cases that occur are usually mild.

Norway has not been exempt from epidemics of malaria. That of 1828–32 visited Christiania, and extended as far north as Bergen. This, so far as I know, is the farthest limit on the north to which the disease in its epidemic form has extended.

Enteric Fever prevails all over the country. It was estimated

[1] *Traité de climat. méd.*, Paris 1877.

by Broch to affect 3 per 1000 of the inhabitants annually. This was some years ago, but during the three years 1885–87 the cases officially recorded averaged 0·83 per 1000 of the population, and formed 0·9 per cent. of the total deaths from all known causes. As the deaths from typhoid fever form 1·2 per cent. of the total mortality in England, we conclude that, at the present time, enteric fever is less fatal in Norway than in England. The following is the ratio of reported cases per 1000 of the population for the three years 1885–87 in the different "stifts":—

Christiania,	0·83	Bergen,	1·2
Christiansand,	0·57	Trondhjem,	0·87
Hamar (inland),	0·23	Tromsö,	1·23

It will be remarked that, so far as these figures go, enteric fever is more common in the north than in the south, while the inland province of Hamar contrasts favourably with the other provinces.

The monthly prevalence of enteric fever will be seen from the following table, which gives the monthly distribution per cent. of 3138 cases observed in 1886 and 1887:—

Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11·3	7·3	8·9	8·4	5·8	6·1	7·0	8·1	9·5	10·5	8·7	8·4

The quarterly distribution was as follows:—

First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.
27·5	20·3	24·6	27·6

The first and fourth quarters are those during which enteric fever is most prevalent; the second quarter is that in which the fewest cases occur. The disease is more common in the country than in the town districts.

Typhus Fever is not endemic in Norway. It would appear that it was introduced into the country, and prevailed epidemically more than once during the seventeenth century. As to the occurrence of the disease in recent times, Hirsch says there is no reliable information going farther back than 1845. From this date the country was quite free from the disease up to 1864, when it was introduced from Sweden and Finland. From that time it would appear never to have entirely died out, for a few cases continue to be reported annually, especially from the northern provinces of Trondhjem and Tromsö. Scattered cases occur throughout the year, several months occasionally passing without a single case being seen; but the most of the cases appear in December or January.

Relapsing Fever is not met with at the present day in Norway, although it has more than once been epidemic at Vadsöe during this century.

Epidemic Cerebro-spinal Meningitis furnishes a certain number of cases every year. The northern provinces are those in which the disease is most prevalent, and the bulk of the cases occur from March to June. The disease is of most frequent occurrence in the country districts.

Diphtheria takes the second or third place among the fatal diseases in Norway, causing (1885–87) 80·8 per 1000, or about one-twelfth of the total mortality. It is slightly more fatal in the country than in the town districts, and attains its maximum prevalence in the cold months (October to January).

Croup is also extremely fatal. One death in 66 is ascribed to croup in Norway, while in England the proportion is one in 112 deaths. It is met with at all seasons; but the cold months of the fourth and first quarters are those in which the disease attains its maximum fatality, and the fewest deaths are recorded in the autumn quarter.

Dysentery is of little account as a sporadic disease in Norway. The average mortality (1886–87) is in the ratio of 1·4 per 1000 of the total deaths; but it is rather noteworthy that the cases are more numerous in the north than in the south, a result which we should not have anticipated.

Here is the monthly distribution per cent. of 558 cases observed in 1886 and 1887:—

Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
5·4	9·0	11·2	8·2	3·6	4·8	8·4	10·0	10·6	10·3	11·3	7·2

Dysentery was epidemic in the southern districts of Norway from 1808 to 1810, and again from 1859 to 1862. On the latter occasion the disease was almost entirely limited to the districts south of Bergen. Epidemic dysentery, like epidemic malaria, thus appears to spare the northern provinces of Norway.

Diarrhœa and *Cholera Nostras* are only moderately prevalent in Norway, as combined they form only about 4 per cent. of the total mortality, which is somewhat under the English proportion. It is about three times as fatal in the town as in the country districts; but there is certainly no decrease in the fatality of the disease in the colder regions of the north, if we are to judge from the ratio which the deaths from diarrhœa bore to the total deaths from known causes during the years 1886–87, as exhibited in the following table:—

Christiania,	6·3	Bergen,	2·5
Hamar,	1·8	Trondhjem,	2·4
Christiansand,	2·7	Tromsö,	3·8

As in all countries, so in Norway, we find the disease to be most common during the summer months, and most fatal in very

warm years. We shall give the monthly distribution of 45,830 cases of acute diarrhœa and cholera nostras observed in 1886–87 :—

Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
6·5	5·9	6·8	7·0	6·5	8·4	15·1	13·5	9·9	6·9	7·3	6·1

Asiatic Cholera. — During the first European epidemy, this disease appeared at Drammen, in the autumn of 1832; and in the following year, Christiania and a few localities on the south coast were attacked. In the autumn of 1834 the south coast suffered more extensively and severely, and in 1848 and 1850 a few districts on the west and south coasts suffered slightly. In 1853 the pestilence once more broke out at Christiania, and spread not only along the shores of Christiania Fiord, which had been invaded during the previous epidemies, but extended inland for some distance, in the districts of Buskerud and Bratsberg, carrying off many victims. More limited and less destructive outbreaks occurred at one or two points on Christiania Fiord in 1855; and in 1857 it broke out at Bergen, which is the most northerly point attained by cholera in Norway.

Influenza. — Norway enjoys no exemption from epidemic influenza, but we hear nothing of the frequent outbreaks of local influenzoid epidemies in spring and summer, which form so important a factor in the pathology of Iceland and the Faröe Islands.

Whooping Cough is about as frequent and fatal in Norway as it is in England and the west of Europe generally. The south and the extreme north suffer alike and equally from the disease.

Smallpox is only met with to a very limited extent, thanks to the efficiency with which vaccination is carried out.

Scarlet Fever is one of the principal causes of death among children in Norway, forming from 3 to 5 per cent. of the total mortality. During the three years 1885–87, the cases officially reported were in the proportion of 5 per 1000 of the population; and the deaths were in the proportion of from 6 to 7 per cent. of the cases treated. The disease appears to be equally prevalent and severe in all the provinces.

Measles.—This disease presents no special features as regards frequency, severity, or distribution calling for remark.

Phthisis takes the first place among the causes of death in Norway. According to Hirsch, the death-rate of the whole kingdom, for the period 1871–75, was 2·5, and that of Christiania, for the ten years 1866–75, was 3·45 per 1000 living. As the deaths from consumption (1871–80) were in the ratio of 2·12 per 1000 for England and Wales, and of 2·51 for London, it will be seen that phthisis is more fatal in Norway than in England, and in Christiania than in London.

This conclusion is confirmed by the proportion which deaths from phthisis bear to the total deaths in the two countries. The mean ratio of deaths from consumption to the total mortality for the period 1884–87, was 15·9 per cent. in Norway, while in England the ratio, in 1884, was only 9·2. The ratio of deaths in the towns districts is 16·9; that in the country districts, 15·1.

We shall now inquire into the relative prevalence of the disease in different parts of the country, and for this purpose we give the ratio of deaths to the total mortality in the six "stifts" for the four years ending 1887:—

Christiania,	14·3	Bergen,	13·4
Hamar,	13·4	Trondhjem,	16·9
Christiansand,	22·8	Tromsö,	13·2

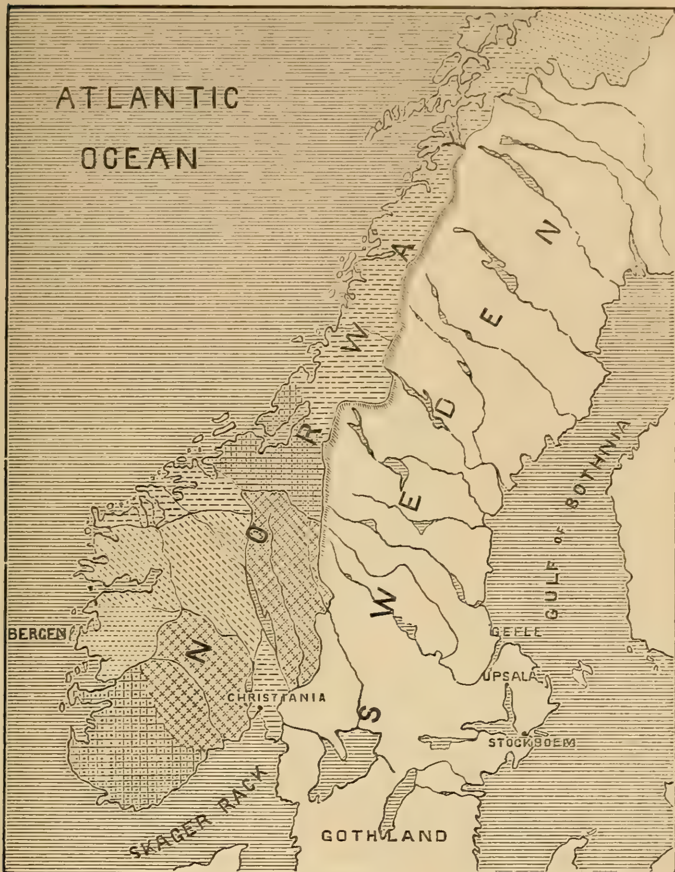
Allowance being made for the influence of the higher death-rate of the capital upon the mortality in Christiania "stift," it appears that the phthisical mortality is pretty equally distributed over the south-east coast (Christiania), the south-east interior (Hamar), the middle Atlantic coast (Bergen), and on the north Atlantic and Arctic Ocean coasts (Tromsö). Two provinces, one in the south (Christiansand) and one on the north-west coast (Trondhjem), stand out as areas of excessive phthisis mortality. This general survey of the distribution of the disease does not appear to point to latitude as the main factor indetermining its prevalence.

In order, however, to trace more minutely the areas where consumption attains its maximum and minimum prevalence, it will be necessary to give the percentage of deaths from phthisis to the total medically certified deaths in the *Amter* or smaller divisions of the provinces. We shall give the mean percentages for the four years 1884–87, the districts being arranged geographically:—

Inland Districts, South-East.			
Hedemarken,	15·3	Christian,	11·2
South Coast Districts.			
Christiania (town),	14·1	Akerhus,	13·5
Smaalenenes,	13·3	Buskeruds,	15·9
Jarlsberg,	15·4	Bratsberg,	17·6
Nedenæs,	23·6	Lister and Mandal,	25·0
West Coast, South of 62°.			
Stavanger,	25·4	South Bergenhus,	14·3
Bergen,	17·4	North Bergenhus,	7·7
West Coast, North of 62°, and Arctic Ocean Coast.			
Romsdal,	14·2	South Trondhjem,	18·3
North Trondhjem,	14·9	Nordlands,	14·0
Tromsö,	13·6	Finmarken,	11·5

The accompanying sketch map will serve to indicate the relative prevalence of phthisis in the different districts.

Map showing the Distribution of Consumption in Norway.



Proportion of Deaths per cent. of Total Mortality.

20–25 p.c., 18–20 p.c., 15–18 p.c., 12–15 p.c., under 12 p.c.,

It will be seen that there are two well-defined areas in which phthisis is in excess—one in the south and the other in the north-west. The southern area, comprising the districts of Stavanger, Lister and Mandal, and Nedenæs, corresponds to the southern portion of the peninsula. The northern area is limited to the district of South Trondhjem. The areas of lowest mortality are North Bergenhus on the west coast (exclusive of the town), Christian amt, in the south interior, and Finmarken on the shores of the Arctic Ocean.

In speaking of the distribution of phthisis in Norway, Homann, as quoted by Lombard, says: "The frequency of phthisis is so much greater as the latitude is southerly, and as the Continental and Baltic

climate predominates over the marine and Atlantic climate." This statement is not entirely in harmony with the figures we have given. First as regards latitude, is it the case that the disease increases in frequency in proportion as we advance from north to south? If we compare the phthisis mortality of Smaalenenes in the south with that of Tromsö in the north, we find that the slight difference between the two is in favour of the southern district. Finmarken, within the Arctic Circle, has, it is true, a low mortality, but that of North Bergenhus, situated 10 degrees farther south, is still lower. Nor does it appear that the districts with a Continental or Baltic climate suffer more than those with a marine or Continental climate. The worst phthisis centre is Stavanger, which has a marine and Atlantic climate; while Smaalenenes with a Baltic climate, and Christian amt with a Continental climate, have a mortality from consumption below the mean. That climate and latitude are not the determining factors in the distribution of phthisis, will become still more evident if we compare the consumption mortality of North and South Bergenhus, or that of North and South Trondhjem. These districts lie contiguous to each other, with a similar climate, yet they differ considerably as regards the degree in which they suffer from phthisis.

The facts point less to the influence of latitude and climate than to the influence of local conditions of the soil, and to the social habits and occupations of the population, in determining the relative prevalence of the disease in different districts.

Other tubercular diseases, including tubercular meningitis, account for 4 per cent. of the deaths from all known causes. Combining the deaths from these various forms of tubercular disease with those from consumption, which, as we have seen, form 15·9 per cent. of all deaths, tubercular affections give rise to no less than 20 per cent. of the total mortality.

Bronchitis.—Acute bronchitis caused 3·6 per cent. of the deaths in the years 1886–87, and the chronic form of the disease 2·1 per cent. Combining the ratios for the two forms, bronchitis accounts for 5·7 per cent. of the medically certified deaths. In England the proportion of deaths from bronchitis to the total mortality in 1884 was 10 per cent. The question arises how far these figures may be accepted as representing the comparative fatality of the disease in the two countries? Differences in nomenclature cannot be invoked in this case to account for the greater prevalence of bronchitis in England, as it is expressly stated that acute bronchitis in Norway includes not only catarrhal pneumonia, which is the disease most likely to occasion confusion, but also laryngitis, which is not included along with bronchitis in the English returns. We conclude, therefore,

that notwithstanding the greater severity of the Norwegian climate, bronchitis is much less fatal in Norway than in England.

Acute bronchitis is notably a town disease, and this goes far to account for the greater prevalence of the disease in England, where so large a proportion of the population is aggregated in towns. In Norway the ratio of deaths in the towns is 5·1 compared with 2·7 in the country districts.

The mean percentage of deaths from *acute* bronchitis to the total deaths in each "stift," for the years 1886–87, was as follows:—

Christiania,	4·1	Bergen,	2·5
Hamar,	3·2	Trondhjem,	2·6
Christiansand,	3·3	Tromsö,	3·1

From this it will be seen that the disease is more fatal in the southern provinces—Christiania, Hamar, and Christiansand—than in the northern districts of Bergen, Trondhjem, and Tromsö.

The maximum mortality from acute bronchitis falls on the cold months, January, February, and March, and the minimum mortality in July, August, and September.

The ratio of deaths in the individual "stifts," from the *chronic* form of the disease, is as follows:—

Christiania,	2·0	Bergen,	2·4
Hamar,	2·4	Trondhjem,	2·1
Christiansand,	2·6	Tromsö,	1·4

Nothing is more distinctly a matter of common observation and of individual experience than that bronchitis, in a vast majority of instances, is the result of a "chill;" but a study of the distribution of the disease in Norway teaches us that the liability to chill is not in relation to the coldness of the climate. Within ordinary limits the human body is capable of accommodating itself, not only to low temperatures, but also to changes of temperature. Those who are habituated to low temperatures and to frequent changes of temperature get inured to these conditions. Thus it happens that those whose daily occupations subject them to constant exposure to cold are the least liable to experience the bad effects of such exposure. The overcrowding, the unhealthy occupations, and the overheated rooms of large, cities account for the greater prevalence of bronchitis in towns. The inhalation of a vitiated or irritating atmosphere, and the exposure of the body to cold after it has been relaxed by heat, are much more potent causes of bronchitis than simple exposure to cold.

Pneumonia.—According to the statistics of Holmsen and Hallin, as given by Hirsch, the average death-rate from pneumonia in Bergen

and Christiania for the ten years ending 1878 was 1·6 and 1·3 per 1000 living, respectively.

From 1880 to 1887 the disease was to a certain extent epidemic, especially in the southern provinces. In the Introduction to the *Medical and Sanitary Report* for 1887, it is stated that, "although the known cases of pneumonia were fewer that year than in any year since 1879, it still prevailed as an epidemy in almost every part of the kingdom." We do not have the data for estimating the death-rate per 1000 living during the epidemic period, but we may be sure that it has been considerably in excess of that given above. The report to which we have referred gives the data for determining the ratio of deaths from pneumonia to the deaths from all causes for the whole kingdom and for the different provinces. Croupous pneumonia gave rise to a mean of 8·1 per cent. of the total deaths in Norway during the three years 1885–87; the proportion in England being 4·9 per cent. This will show how prevalent pneumonia has been of late years in Norway.

The relative prevalence of the disease in different parts of the kingdom is shown by the average number of cases reported in each "stift" per 1000 living, as under:—

Christiania,	5·7	Bergen,	4·5
Hamar,	7·0	Trondhjem,	4·5
Christiansand,	4·7	Tromsö,	3·0

Pneumonia was thus most fatal during these years in the inland province of Hamar, and the southern provinces generally suffered more severely than the northern parts of the country.

The disease is more fatal in the country than in the towns, in the proportion of 9·5 : 6·3.

The following is the monthly distribution per cent. of 18,706 cases of the disease:—

Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11·1	10·3	13·1	12·4	13·6	7·4	4·8	3·2	2·9	5·0	7·3	8·7

Pleurisy is of frequent occurrence, at least it has been so during recent years, the proportion of deaths in 1886–87 being as high as 5 per 1000 of the total mortality. It is most fatal in the first, and is least fatal in the autumn quarter.

Hepatitis and *diseases of the Spleen* are of rare occurrence in Norway.

Cancer and *Sarcoma* are excessively fatal in Norway, and appear to be increasing in prevalence. Founding upon the statistics of Dr. Kjier, Lombard estimates the deaths from cancerous affections at 32 per 1000 of the total mortality. These figures have reference to a period anterior to 1877. During the years 1886–87 the

proportion was 60 per 1000, or 6·0 per cent. The percentage of deaths to the total mortality in each "stift" in 1886, from cancer alone, was as follows:—Christiania, 5·0; Hamar, 9·8; Christiansand, 4·3; Bergen, 5·4; Trondhjem, 6·6; Tromsö, 6·0. The inland province, Hamar, where cancer is so prevalent, comprises two districts—Hedemarken to the east and Christian to the west. It is the eastern part of the province where cancer is most prevalent; the deaths in Hedemarken being in the ratio of 10·6, while the ratio in Christian amt is 8·8 per cent. Such is the distribution of cancer in Norway, but I cannot offer any explanation of the facts, any more than I can explain why cancer should be so prevalent in Norway, while among the same race in the Faröe Islands the disease should be almost, if not altogether, unknown. We certainly have no reason to attribute the difference to climate or soil, and if it is due to any peculiarities in the food or the habits of the people, I cannot conjecture what these may be.

Diabetes forms about 2·5 per 1000 of the total deaths in Norway, and about 2·7 in England. The disease is thus equally frequent in the two countries.

Scrofula is far from rare in Norway. It appears to be most frequently met with in the southern districts, that is, in the districts where phthisis is most prevalent.

Rheumatic Fever.—The proportion of deaths from rheumatic fever to the total mortality is slightly under that which obtains in England. The months of January, February, and March are those when rheumatic fever is most frequent; August, September, and October are those during which the fewest cases occur.

Goitre is not met with in Norway.

Leprosy finds one of its chief areas of prevalence, so far as Europe is concerned, in Norway, although the disease is evidently dying out here, as it has already done in so many European countries. The number of lepers known in 1885 was 1139, or 5·8 per 10,000 living. In 1856 the proportion was estimated at 19·1 per 10,000. We may thus anticipate the complete extinction of the malady within the next fifty years. The disease is most common in North and South Bergenhus, but it occurs all along the west coast, and a few cases are met with in the other districts. The coastal distribution of the disease in Norway is one of the arguments of those who, like Hutchinson, ascribe leprosy to a fish diet.

Syphilis is no doubt common enough in Norway at the present day; but so far as can be judged from the deaths ascribed to the disease, it is less prevalent in Norway than in England. During the last century and the first half of the present century, a disease

known as *Radesyge*, or the "bad disorder," was endemic, especially in the provinces of Bergen and Christiansand. This disease is believed by Hebra, Bäumler, Danielssen, and others to have been nothing else than forms of secondary, tertiary, or congenital syphilis. Historically the disease is interesting in relation to the doctrine of syphilis, and it deserves notice also on account of its affinities to similar endemic diseases met with elsewhere. A full account of it by Dr. Hjort will be found in the *Brit. and For. Med. Rev.* for 1842. From this I shall give a very condensed account of the principal features of this malady. The disease was in most cases preceded by catarrhal, rheumatic, or nervous symptoms, the most constant of these being flying pains in the limbs, head, skin, and ulna. They were followed by periostitis and thickening of the bones, followed by ulcerations of the skin, mucous membranes, and bones. The disease, as affecting the integument, might be limited to the skin proper, or, as was more common, it might involve the skin and subcutaneous cellular tissue, occasionally extending deeply, and laying bare the muscles and ligaments. The most common form of ulceration, we are told, began with round tubercles, elevated two or three lines above the surface of the skin, of a dirty-white colour, and varying in size from a hazel-nut to that of a walnut, which on softening displayed an ulcer two or three lines in depth, secreting a yellowish-green pus, which formed hard black scabs. The ulcers generally appeared in groups on the loins and extremities, particularly over the anterior surface of the tibia; but ulcers grouped in irregular forms, and not presenting the serpiginous circles of syphilitic eruptions, were also met with on the forehead, cheeks, back, and breast.

The mucous membranes most liable to be attacked were those of the nose, mouth, and pharynx, leading to destruction of the soft parts, and sometimes of the bones. Necrosis of the long bones was also not uncommon during the progress of the disease.

Faye affirms that "radesyge" appeared many years after birth in *previously healthy* children.[1] In such instances, we cannot well suppose that the disease was congenital, and the age of the patients, in many instances, renders it impossible to believe that it was contracted by sexual intercourse. Assuming, as we are entitled to do, that the disease was chiefly propagated by ordinary intercourse, such as by eating out of the same dish, it is remarkable that we have no accounts of primary sores, or even of secondary affections, such as condylomata, which play such an important part in the descriptions of endemic syphilis in other countries.

[1] Schmidt's *Jahrb.* vol. cxvii. p. 174.

CHAPTER III.

SWEDEN.

GEOGRAPHY.—Sweden occupies the eastern and more extensive part of the Scandinavian peninsula. It extends from 55° 20′ to 69° 3′ N. lat. Its area is 170,000 square miles, and the population, in 1887, was 4,734,901. Stockholm, the capital, in 1887, had 227,964 inhabitants.

Physically, Sweden may be divided into three regions. The northern division is limited on the south by the 62nd degree north latitude. It slopes from the Kiolen range of mountains, which here separates Norway from Sweden, down to the Gulf of Bothnia. The middle region, which extends from lat. 57° to 62° N., may be called "the lake" region, and has a slope southwards to the Wetter, Venner, and Maelar lakes, which, with numerous smaller ones, almost intersect the country from the Baltic to the Skager Rack. The southern division comprises all the peninsula south of lat. 57° N. This division is, in general, level and fertile, and contains several lakes of considerable extent. Nearly one-fourth of the entire surface is covered with forests, and the lakes are estimated to amount to nearly one-eighth of the area of the country.

The rivers of Sweden are numerous, but short and rapid. The largest is the Angermann Elf, which falls into the Gulf of Bothnia.

The country is divided into twenty-five provinces, with a population (in 1887) as under:—

Stockholm (town),	227,964	Göteborgs och Bohus,	289,957
Stockholm (provinces),	152,160	Elfsborgs,	279,217
Upsala,	120,084	Skaraborgs,	251,939
Södermanlands,	152,296	Vermlands,	256,842
Ostergötlands,	266,084	Örebro,	182,895
Jönköping,	196,071	Vestmanlands,	134,625
Kronobergs,	165,009	Kopparbergs,	195,667
Kalmar,	236,333	Gfleborgs,	199,044
Gotlands,	52,065	Vesternorrlands,	193,868
Blekinge,	141,677	Jemtlands,	97,474
Kristianstads,	226,070	Vesterbottens,	116,910
Malmöhus,	364,543	Norrbottens,	98,709
Hallands,	137,398		

CLIMATOLOGY.—The mean temperature centigrade from south to north is as follows:—

	North Latitude.	Jan.	April.	July.	Oct.	Year.
Kalmar, ...	56° 40′	− 1·1	4·5	16·8	7·9	6·8
Jönköping, ...	57° 40′	− 2·0	4·0	16·1	6·5	5·9
Stockholm, ...	59° 17′	− 3·7	3·0	16·4	6·2	5·2
Falun, ...	60° 36′	− 6·6	2·3	16·2	4·5	3·7
Haparanda, ...	65° 51′	−13·1	−2·0	15·2	1·2	0·0

The following is the monthly distribution per cent. of the rainfall in the north and south of Sweden:—

North Latitude.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
56°–60°	7	5	5	6	7	10	11	13	10	10	9	7
60°–66°	6	5	5	5	7	9	12	14	11	10	9	7

The average annual amount of rain varies from 18 to 24 inches in different parts of Sweden.

VITAL STATISTICS.—The marriage, birth, and death rates per 1000 for the ten years ending 1886 were 12·8, 29·7, and 17·6 respectively. Sweden thus ranks among the healthiest countries of the world.

The seasonal distribution of the mortality in the northern, central, and southern provinces of Sweden is thus given by Lombard:—

	Five Northern Provinces.	Four Central Provinces.	Thirteen Southern Provinces.
Winter, . . .	27·19	28·32	27·94
Spring, . . .	26·69	27·59	29·62
Summer, . . .	22·41	21·19	19·58
Autumn, . . .	23·71	22·90	22·86

Summer in all the regions stands out as the healthiest season. In the north and centre of the country winter is the season when the highest mortality occurs. According to the same authority, the maximum mortality in Stockholm during the period 1851–61 fell on the autumn season, the month of September being that most charged with deaths. This Lombard ascribes to the predominating influence of malaria, owing to the situation of the city in proximity to the Maelar Lake.

PATHOLOGY.—*Malaria.*—Intermittent fever is much less fatal at the present day in Sweden than it was during past centuries, or even during the earlier part of the present century. In Sweden, as in England and Holland, malaria is gradually falling into the background as an endemic disease. This diminishing fatality, as regards Sweden, will be seen if we compare the deaths from malarial fever for the three decennial periods 1751–60, 1801–10, and 1861–70, as deduced from the statistics of malarial mortality given by

Bergman.[1] During the first of these periods the deaths from intermittent fever numbered 12,964; during the second, 8165; while during the third the number of deaths had fallen to 1192. The following is the number of cases (not deaths) reported yearly from 1880 to 1887 by the Swedish Board of Health:—

1880,	4180	1884,	3740
1881,	2776	1885,	2538
1882,	2700	1886,	2297
1883,	3602	1887,	1591

The number of reported cases formed, in 1887, the small proportion of 3·36 per 10,000 of the population, and of these only 4, or 2·5 per 1000 treated, proved fatal. Although the number, both of cases treated and of deaths reported to the Board, must have been considerably under those that actually occurred throughout the country, these figures nevertheless show that malaria is comparatively rare and mild in Sweden at the present time.

Malarial fever is endemic along the east coast, from the southern extremity of the peninsula as far north as Hudiksvall, which is close upon the 62nd degree, and it is met with at a few isolated points beyond this, near the mouths of some of the rivers, such as the Angermann Elf, where it is rather common.

The shores of the Kattegat, on the west, are almost entirely free from the disease, except around Göteborg, and even there it is mild. That part of the east coast situated to the north of Gefle is little affected, as is also that south of Carlscrona on the south. The worst malarious areas on the east coast are found in Kalmar and Södermanlands. The shores of Lake Maelar have a clayey subsoil, which maintains the subsoil water at a high level, and here malaria is specially prevalent. The northern shores of Lake Venner are also in a marked degree malarious, and the east, west, and south of the lake are affected, although to a much less extent. Lake Wetter and the whole of the inland country to the south are free from endemic malaria. Malaria is not endemic in the provinces north of 62° N. lat., nor in the high lands of the interior.

The remittent form has a much more restricted area of endemic prevalence. It is of somewhat frequent occurrence in Kalmar, on the coasts of Södermanlands, and on the shores of Lake Maelar, but outside these districts it cannot be said to be endemic.

Three factors determine the distribution of malaria in Sweden, viz. altitude, latitude, that is, temperature, and local conditions of the soil, the most evident of which is subsoil humidity.

The influence of altitude is shown in the absence of the disease

[1] *Om Sveriges folksjukdomar*, Upsala, 1875, p. 149.

from the whole of the Alpine districts, and even from the higher lands in the interior. No less evident is the influence of latitude on the prevalence of malarial fevers. Taking the recorded cases in 1887, for each "län," the distribution of the disease for four different parallels was as follows:—

Parallels.	Ratio of Cases per 10,000 living.
North of 62°,	0·31
60°–62°,	1·80
58°–60°,	4·40
South of 58°,	3·09

Malarial fever is seen to diminish in frequency as we advance north of latitude 60°; but to the south of this line the disturbing element of local conditions of soil comes into operation. The influence of the paludal conditions arising from the lakes is shown by the fact that whereas the ratio of cases of fever for the whole country is, as we have seen, 3·36 per 10,000 living, the proportion in the six lake departments is 7·49 per 10,000. This indicates the influence of the third factor, viz. paludal conditions of the soil in the genesis of malaria.

The following are the six most malarious departments in Sweden, with the ratio of cases per 10,000 of the population for the year 1887:—

Södermanlands,	14·7	Stockholm (city),	8·9
Kalmar,	13·5	Upsala,	8·4
Stockholm (län),	12·4	Vermlands,	4·8

Having now traced the geographical distribution of malaria in Sweden, let us examine its seasonal prevalence.

The subjoined table gives (1) the monthly distribution per cent. of 53,009 cases of malarial fever for the whole country from the reports of the Board of Health for the years 1870–73; (2) of 2835 cases occurring between 1864 and 1873 at Göteborg; (3) of 6526 cases at Stockholm between 1860 and 1869. I shall add the monthly temperature of Stockholm to show the relation which the prevalence of malarial fever bears to temperature in Sweden:—

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Sweden,	5·94	6·47	10·24	15·35	16·6	9·22	5·40	5·18	7·03	7·12	6·41	5·43
Göteborg,	8·7	9·5	11·9	11·7	12·7	7·5	4·3	4·0	6·2	9·0	8·5	5·9
Stockholm,	8·8	7·8	9·3	11·3	12·5	10·1	5·8	5·8	7·3	7·1	6·7	7·4
Mean monthly temperature of Stockholm,	–3·63	–3·33	–1·87	3·23	8·35	15·44	16·85	16·56	11·88	5·45	–0·83	–3·33

It will be seen from these figures that malarial fever has two maximal periods, the principal one in May, and the secondary one in September or October; but that the monthly proportions vary in different localities and periods.

The rule appears to be that the autumnal crop of fevers is large in proportion to the intensity of malaria either in its endemic or epidemic form. In the extreme north the autumn rise disappears, unless, perhaps, during epidemic years; but it becomes more marked in the centre and south, especially in the years when the disease is prevalent. Thus, at Strömsholm, on the northern shores of the Maelar Lake, malarial fever was very prevalent in 1859, and less so in the following year, 1860. In 1859 the maximum occurred in October, while in 1860 the usual May maximum was observed.

As an endemic malady, malarial fever is thus mainly vernal in all parts of Sweden, and most of all in those districts where the endemic influence is least felt, but it tends to become autumnal in those regions where malaria is more intense, especially during seasons when the disease is epidemic.

It will be observed that cases of malarial fever are absolutely more prevalent at Stockholm in the month of March, when the mean temperature is below the freezing point, than in the month of July, when it stands at 16·85° C. We shall revert to this point when we come to deal with the seasonal distribution of malarial fevers in Russia.

The tertian type is that which is most common in Sweden. Taking as our basis a table given by Bergman, showing the number of cases of each type at various places and in different years between 1851 and 1868, the different types were represented in the following proportions:—

Tertian, . . .	57·1 per cent.
Quotidian, . . .	26·4 ,,
Quartan, . . .	16·4 ,,

The following is the quarterly prevalence of each type:—

	First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.
Tertian,	11·9	76·2	10·6	1·2
Quotidian,	11·5	73·9	10·8	3·7
Quartan,	32·1	19·6	26·8	21·4

These percentages are calculated upon 1401 cases of tertian, 406 of quotidian, and 56 of quartan, observed at Atvidabergs from 1856 to 1860, that is, during an epidemic period, and the proportions must be taken with some reservation as respects non-epidemic years. Further, the number of cases of the quartan type are too few to establish conclusively its seasonal prevalence. Children suffer in a larger proportion than adults from the quotidian type.

Males are more liable to suffer from malarial fever than women; the proportions being 58·1 per cent. of cases in males, and 41·9 per cent. in females.

The proportion per cent. in which the different age classes suffer is given by Bergman as follows :—

Under 10 years.	10–20.	20–30.	30–40.	40–50.	Over 50 years.
21·9	17·7	23·3	18·6	10·6	7·9

Malarial fever has repeatedly broken out in Sweden in an epidemic form, the earliest outbreak of which there is any record dating as far back as 1575–76. Bergman enumerates fourteen such epidemies as occurring between the years 1691 and 1861, and most of these coincided with or followed the epidemic prevalence of the disease in other regions of Europe. It would appear from the dates assigned to these epidemies by Bergman, that Sweden has, as a rule, been visited by malarial outbreaks one or two years after the disease has been more or less general in other parts of Europe, which would point to an extension of the infective influence from south to north; but it is always so difficult to fix the dates at which an epidemy begins and ends in any country, that the conclusions based upon such dates, especially when these refer to past centuries, must be received with some reserve. The latest epidemic outbreaks occurred in 1852–56 and 1858–61. These may be regarded as one epidemy. It commenced in 1852, at three points on the east coast, viz. Christianstad, in the south; at Kalmar, on the south coast; and on the southern part of the Stockholm coast. During the succeeding years up to 1860 it invaded the whole south and east coasts to the northern extremity of the Gulf of Bothnia, and extended inland along the lakes, and over a large extent of the centre and south, where the disease is not endemic. The west coast also suffered during this outbreak, as well as the islands of Gotland and Öland.

Speaking generally, the epidemy, starting from its three primary centres, spread circumferentially, in widening circles each successive year, yet in such a manner that the humid and marshy localities in which the disease is usually endemic were attacked in advance of the extending epidemic wave.

As the manner in which malarial epidemies spread has seldom been so carefully noted as in Sweden, I shall reproduce the map constructed by Bergman to illustrate the progress of the epidemy year by year.

Enteric Fever is extensively prevalent in Sweden. The average number of cases recorded during the eight years ending 1884 was 13,210; and as the mean population for the same series of years was 4,570,047, this gives a ratio of nearly three cases per 1000 of the population annually. The average death-rate for the two years

Map showing the Spread of Epidemic Malaria in Sweden, 1852–61.

1886–87, in ninety-one towns having a total population in 1886 of 815,220, was 263 per million, or 0·26 per 1000. These towns are of all sizes, from Säter, with a population of 571, to that of Stockholm, with 219,376. In England, the average death-rate from enteric fever for the smaller towns may be stated at 0·24 per 1000, which is somewhat under the rate which obtains in Sweden.

This disease is less fatal in the four northern provinces of Norrbottens, Vesterbottens, Vesternorrlands, and Jemtlands than in the middle and southern divisions. The region included between 58° and 60° N. lat. appears to suffer most from enteric fever. In Sweden, enteric fever is generally of a mild type. In 1886, out of 6045 recorded cases, there were 589 deaths—a proportion of 9·7 per cent. Out of 383 admissions into hospital, 34 patients died—a ratio of 8·9 per cent. Liebermeister estimates the mortality at Basle hospital at 16 or 17 per cent. of the cases treated; while Murchison's tables give for England a mortality of 18·5 per cent. of the cases treated.

The monthly distribution of 10,743 cases of enteric fever occurring in 1886–87 was as follows:—

Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
8·88	6·51	6·81	5·88	6·27	5·71	8·09	10·33	11·53	9·99	11·24	8·69

The disease is thus most prevalent during the autumn months, when the rainfall is beginning to diminish; but the increase commences during the months of July and August, when the rainfall is at its maximum.

The disease varies considerably in prevalence in different years. I do not have the data for comparing the death-rates from typhoid fever for a series of years in England and in Sweden; but it may be interesting to compare the annual prevalence of the disease in the two countries during a series of years, as indicated by the number of reported cases of typhoid and gastric fever reported annually in Sweden, and the death-rates per million from typhoid fever in England. The following are the numbers for the years 1877–84:—

	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.
Sweden—Cases of Typhoid and Gastric Fever, .	12,786	16,958	13,192	12,654	11,137	14,138	12,063	12,757
England — Death-rate per million from Typhoid Fever, ...	279	306	231	261	212	229	227	235

Although no conclusions can be drawn from such imperfect data, it is interesting to observe that the deaths from typhoid fever in England rise and fall, in a rough way, with the number of cases of typhoid and gastric fever reported annually in Sweden, with the single exception of the year 1880, when an increase in the number

of typhoid fever deaths occurred in England along with a decrease in the prevalence of the disease in Sweden. This suggests the question, whether the conditions which determine the prevalence of typhoid fever do not extend simultaneously over large areas of the earth's surface? It is not improbable that the summer temperature has an important influence on typhoid mortality in Sweden, as will be proved to be the case in respect to other countries from which data are available. The average annual number of cases of typhoid and gastric fever recorded during the ten years 1878–87 was 12,474. The mean temperature of the third quarter at Upsala for the same period was 13°·8 C. The temperature of the third quarter in 1884 was exactly that of the mean of the ten years. Omitting, therefore, this year, we find that in six out of the remaining nine years when the temperature of the third quarter was above or below the mean, the number of cases of typhoid and gastric fevers was also correspondingly above or below the average. This seems to show that a high temperature during the third quarter tends to increase the number of cases of these diseases, while a low temperature has the opposite effect.

Typhus Fever was epidemic in various parts of Sweden from 1873–75. In recent times isolated cases are annually observed. A few cases of *relapsing fever* were observed during the typhus epidemy.

Gastric Fever is returned as the cause of much sickness. It appears to answer to the "simple and ill-defined fever" of the English reports. Whatever may be its nature, it is clearly not malarial, as it appears to be quite as prevalent in the non-malarious as in the malarious localities. Like simple continued fever, the gastric fever of Sweden is seldom fatal.

Epidemic Cerebro-spinal Meningitis made its first appearance in Sweden at Göteborg, on the west coast, early in 1854, and towards the end of the same year in Kalmar and Blekinge; and for the next ten years it raged throughout the country with great severity. Its progressive extensions from south to north could be traced in successive years. In 1855 it had reached the town of Kalmar; in 1856 it had extended north to Philipstad. In 1857 it attained to latitude 61° N.; in 1858, a year in which it was widely diffused and severe, it penetrated as far north as latitude 63° N., which was the farthest point to which it attained (Hirsch). During these years the epidemy died out after May or June, to recommence in the beginning of the following year. During the ten years ending 1886, the number of recorded cases averaged 85 per annum. A considerable recrudescence of the disease was witnessed in 1883, when the number of cases recorded rose to 400. Since that period

the disease has occurred in single cases or in small groups of cases at various points in the south and centre. Cerebro-spinal meningitis is eminently a disease of the second quarter.

Diphtheria.—We have accounts of the epidemic prevalence of diphtheria or *Cynanche maligna* reaching as far back as 1755–62. In 1852–55 fatal throat affections were epidemic in various parts of the country. A wider extension of the disease began in 1860, and since that period it has taken its place among the more fatal epidemic diseases of Sweden.

The cases observed between 1863–70 numbered, according to Hirsch, 18,156. This gives on an average 2269 cases annually. The cases reported to the Board of Health, during the ten years ending 1886, were on an average 5934. The disease has thus been more widely diffused during the latter than the former period.

The mortality in proportion to cases reported from 1863–70 was 23 per cent., while in the latest years, 1886–87, it was 21 per cent.; which shows that the malady has lost little in its virulence, while it has been gaining in frequency.

The recorded cases in 1886 and 1887 were in the ratios of 9·7 and 12·2 per 10,000 living respectively. The average number of deaths from diphtheria in 1886–87 in ninety-one towns, with a mean population of 824,390, was 313·5; which gives a death-rate of 380 per million living. The ratio which the deaths from diphtheria bore to the deaths from all causes was for the same years 20·8 per 1000. As a measure of comparison, we may note that in England the death-rate from diphtheria (1881–84) was 154 per million, while the ratio of deaths from this disease to the total mortality was about 9·4 per 1000.

Diphtheria is more prevalent in the northern and central than in the southern provinces. Stockholm often suffers severely from the malady.

The fourth and the first quarters are those in which the maximum of diphtheritic sickness is observed, but the exact period is very variable.

Croup takes a somewhat important place among the fatal diseases of infancy. The average number of recorded cases during the ten years ending 1886 was 492·5. During the period 1863 to 1867 the proportion was considerably higher, viz. 611 cases annually. Whether this difference indicates a diminished prevalence of the disease during the later period is doubtful. I think it more probable that cases formerly returned as croup are now registered as diphtheria. Croup, like diphtheria, is less prevalent in the southern than in the northern and central divisions; and if we leave out Stockholm from

the central division, croup is more fatal in the north than in the centre. The disease is specially fatal in the capital; and, according to Hirsch, in Dahlsland and Wermland around the shores of Lake Venner, particularly in the districts of Näshärad and Amål, where the By-Elf flows into the lake. The death-rate from croup in the towns (including Stockholm) in 1886–87 was 228 per million (0·22 per 1000); the ratio of deaths from croup to the total mortality was 12·50 per 1000. The corresponding ratios for England (1881–84) were 164 per million living, and 8·9 per 1000 of the total deaths. The death-rate in Stockholm from croup during these years was as high as 290·4 per million. Croup is most fatal in the first quarter, and attains its minimum during the summer months.

Diseases of the Digestive System.—Before considering the individual diseases of the intestinal canal, we may remark that diseases of the digestive system are slightly more prevalent in the south than in the centre and north of Sweden, and that this class of diseases is most fatal in the capital. The following is the mean percentage of deaths from this class of diseases to the total deaths in different parts of the kingdom for the years 1886–87 :—

The Skäne Towns (South).	Maelar Provinces (Towns).	Northern Provinces (Towns).	Stockholm.
13·57	12·41	13·05	14·69

The influence of increasing temperature, and of the agglomeration and misery of large towns, in raising the mortality from diseases of the digestive system, is here apparent, although not to a marked extent.

Dysentery has of late years lost much of its importance in Sweden as an endemic disease, and its epidemic ravages are much less frequent and severe than during the last and the earlier part of the present century. Among the notable epidemies of dysentery by which Sweden has been visited, we may enumerate those of 1649–52, 1736–43, 1749–50, 1770–75, 1783–85, 1808–11, 1813, and 1838–39. The last extensive outbreak of dysentery occurred from 1853 to 1860, a period when, as we have seen, malaria was also epidemic. This outbreak began in the south-west in 1852 and 1853, invading during the latter year the provinces of Elfsborgs and Vermlands. In the following year, 1854, the epidemy extended to the east and south, attacking the provinces of Skaraborgs and Jönköping, while it still continued its ravages in Vermlands. In 1855 and 1856 it lingered on, but with diminished virulence, increasing again in 1857, during which and in the following years all excepting the two northern provinces of Vesterbottens and Norbottens, the two southern provinces Malmöhus and Khristianstadts, and the central province of Södermanlands, were

successively attacked. Its northern limit was 65° N. The severity of this epidemy may be judged by the fact that, during the eight years in which it raged, it carried off 19,999 victims, or nearly 2500 annually.

The districts most affected will be seen from the following table from Hirsch, showing the deaths from dysentery in Sweden per 100,000 inhabitants during the period 1851–60 :—

Jönköping,	395·8	Nerika (Vermlands),	23·8
Skaraborg,	255·1	Hallands,	11·1
Elfsborg,	197·2	Stockholm (city),	7·2
Vermland,	121·7	Stockholm (län),	6·6
Göteborg and Bohus,	92·7	Norrlnad,	6·4
Kalmar,	82·7	Upsala,	3·4
Östergötlands,	50·4	Gefleborg,	2·8
Götlands,	48·7	Vestmanland,	2·0
Blekinge,	38·9	Södermanland,	0·6
Vexio,	37·1	Malmöhus,	0·3
Falun (Dalarne),	34·5	Kristianstadts,	0·0

The following points deserve notice respecting epidemic dysentery in Sweden:—(1) Its greater malignancy during epidemic periods. During the outbreak of 1853–60, the deaths to the cases treated were in the ratio of 28 per cent., which is more than double that observed in non-epidemic periods. (2) Its mode of extension,—gradually and progressively invading large areas during successive years, which seems to point to its miasmatic character. (3) Its relation to locality. Dysentery in Sweden has frequently been most fatal in elevated districts, and in the last epidemy it will be observed that the malarious and low-lying province of Södermanland was almost exempt from the disease. (4) Its relation to weather and season. It has been proved by Bergman that dysentery most frequently shows itself in an epidemic form during unusually hot weather, and it makes most victims during the warmest months.

The disease in non-epidemic periods is marked by the great differences in its frequency in different years. This will be seen from the following figures of the cases recorded during the ten years ending 1887 :—

Years.	Cases.	Years.	Cases.
1878	587	1883	512
1879	245	1884	357
1880	1014	1885	179
1881	814	1886	694
1882	4211[1]	1887	254

[1] This high number of cases was owing to an epidemy of the disease limited to Malmöhus, where there occurred 3150 cases and 602 deaths.

The northern provinces are little subject to endemic dysentery, but they are not entirely exempt from the disease. Thus, in 1886, no fewer than 11 out of 53 deaths ascribed to dysentery occurred in the province of Vesterbottens. In ordinary years the disease is more prevalent in the central than in the northern and southern divisions, the province of Vermlands being that in which the disease is most common. Dysentery is more common in the country than in the towns; and the months of July, August, and September are those in which the disease attains its maximum. The mortality from the endemic form varies from 8 to 11 per cent. of the cases treated.

Diarrhœa.—The average number of cases of diarrhœa and *Cholera infantum* recorded between 1877 and 1886 was 24,883, or an average of 5·4 per 1000 on the mean population for that period; the deaths being in the proportion of from 3 to 5 per cent. of the cases reported. Diarrhœa is more fatal in the towns than in the country. In Stockholm the deaths from diarrhœal diseases for the four years ending 1888 were in the high proportion of 2·77 per 1000 living. The following was the regional distribution of cases of the disease reported in 1886 and 1887 per 1000 of the inhabitants:—

		1886.	1887.	Mean.
North,	Vesterbottens, Norbottens,	6·0	3·8	4·9
Inland,	Jemtlands, Kopparbergs,	6·2	4·7	5·4
Central,	Vestmanlands, Södermanlands,	5·7	5·3	5·5
South,	Kristianstadts, Malmöhus,	6·5	5·4	5·9

From this it appears that diarrhœa increases slightly in frequency from north to south.

Diarrhœa attains its maximum throughout the country in the months of August and September.

Asiatic Cholera made its first appearance in Sweden in 1834, which has subsequently been visited by the disease in 1850, 1853, 1857, and 1866. On all of these occasions the chief centres of cholera prevalence have been "the basins of Lake Maelar, Lake Wetter, the valley of the Göta-Elf, and the southern belt of country extending from Malmö round to Karlshamm" (Hirsch).

Influenza appears in Sweden with the same frequency and intensity as in the rest of Europe.

Smallpox caused on an average only 158 deaths per million living from 1810 to 1850. From 1856–62 the disease was more prevalent, while from 1863 to 1867 smallpox assumed epidemic dimensions, carrying off during that period 7291 victims. In

1874 there were no fewer than 2774 deaths recorded, the highest number in any year since 1801. From 1877 to 1886 the average number of cases was 670; but the deaths have been comparatively few.

The quarterly distribution per cent. of 5257 deaths occurring between 1856–62 was as follows:—

First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.
38·6	33·4	14·9	13·1

Scarlet Fever.—During the ten years 1877–86 the average number of cases of scarlet fever observed annually in Sweden was 11,845, or nearly 2·6 per 1000 living. The mortality to cases treated varies from 12 to 13 per cent. The year 1877 was the most fatal of the series. The cases that year numbered 16,682, and the deaths 7426, or nearly 1·7 per 1000 of the population. The disease is more fatal in the towns than in the country. The average mortality in the towns of late years has been 6·00 per 10,000 living. The percentage of deaths in the different seasons is—spring, 22·1; summer, 23·9; autumn, 29·4; winter, 24·6.

Measles.—The average number of cases observed during the ten years ending 1886 was 9727, or a ratio of 2·3 cases per 1000 living, with an average mortality in recent years of 2·40 per 10,000 living. The disease takes on an epidemic character at varying intervals. Thus it was excessively prevalent during the three years 1881, 1882, and 1883, especially in 1882, when the cases rose from the mean of 9727 to 20,724. Measles were epidemic in Lapland in 1852. The disease is most prevalent during the cold months.

Whooping-Cough is quite as common in Sweden as in neighbouring countries. The cases reported during the ten years 1886 were in the ratio of 1·7 per 1000 of the population. The deaths are in the ratio of 5 per 100 of the reported cases. If the statement of Rosenstein, quoted by Hirsch, is correct, that upwards of 43,000 children died of whooping-cough in Sweden from 1749 to 1764, that is, during a period of sixteen years, it must have been very much more fatal during the last than during the present century. The percentage of cases in the several seasons, as given by Hirsch, is as follows:—spring, 21·8; summer, 28·2; autumn, 29·4; winter, 20·6.

Diseases of the Respiratory Organs become more fatal as we advance from the north to the south. This, at least, is the case if we are to accept the ratio of mortality to the total deaths in 1886 and 1887 as evidence of the ordinary distribution of the deaths from

these diseases. The following table gives the percentage of deaths from respiratory diseases for the towns in three regions, and separately for the capital:—

The Skäne Towns (South).	Maelar Towns (Centre).	Northern Towns.	Stockholm.
35·12	32·15	31·65	30·50

Phthisis is extremely fatal in Sweden. The average death-rate during the period 1861–76, as given by Hirsch on the authority of Devertie, was 3·5 per 1000 living.

Since that time it has probably diminished in frequency, for the death-rate from phthisis and chronic pneumonia, which are included in the term "*lungsot*," in ninety-one towns, during the years 1886–87, was in the ratio of 2·72 per 1000 living, and formed 14·96 per cent. of the total deaths.

The following table gives the death-rate from phthisis in twenty-nine towns situated in four parallels of latitude, the capital being excluded. It shows that, for the years 1886 and 1887, phthisis was more fatal in the centre and south than in the north. The region lying between 58° and 60° N. lat., which includes the lakes, and in which the malarial influence is most marked, is that where consumption is most prevalent:—

	Number of Towns.	Population in 1886.	Deaths from Phthisis per Million in 1886.	Deaths from Phthisis per Million in 1887.	Mean.
North of lat. 62°, . .	7	31,050	2930·7	2385·9	2658
Between lat. 62° and 60°, .	5	43,150	2688·3	2448·4	2568
Between lat. 60° and 58°, .	9	99,509	3336·4	3034·8	3185
South of lat. 58°, . .	8	214,798	2821·2	2860·2	2840

The provinces of Södermanlands, Kristianstadts, Jemtlands, Kopparbergs, and Vesternorrlands are those in which phthisis is most prevalent; while Elfsborgs, Vestmanlands, and Norrbottens are those which are least affected.

Pneumonia and Pleurisy are of frequent occurrence in Sweden, and the deaths occasioned by these diseases are more numerous in proportion to the population than in England. The death-rate in the towns for 1886–87 was 1·81 per 1000. The death-rate from pneumonia at Falun for 1860–66 was almost exactly the same as for the towns generally, viz. 1·8 per 1000. The death-rate from pneumonia is considerably higher in Stockholm than that of the country as a whole, being 2·18 per 1000 for the two years 1886–87. According to the investigations of Lombard into the geographical distribution of pneumonia, as deduced from the mortality of the five years 1863–67, the central provinces are those which are most affected, while the southern provinces furnish the lowest number

both of patients and deaths. The maximum of deaths occur in spring, and the minimum in autumn.

Bronchitis is moderately common. The regions are affected in the same order as in pneumonia. At Falun, in the interior, bronchitis forms rather more than one-fifth of the diseases treated.

Diseases of the Liver and Spleen are of rare occurrence in Sweden.

Cancer caused a death-rate in 1886–87 of 0·95 per 1000 living, a rate which is exceeded in few countries in Europe.

Goitre is endemic only in a few localities in Kopparbergs and Vestmanlands.

Chlorosis was a rare disease in Sweden even so late as the first quarter of the present century. During the last fifty years it has gradually been growing in prevalence, and is, at the present day, so common that in some districts very few young women are free from the disease. It is most common in the central and southern provinces.

Leprosy is now rare in Sweden, and is rapidly dying out. It is chiefly confined to the province of Gefleborg. In 1887 the number of known lepers was 68, viz. 41 males and 27 females.

Syphilis is widely diffused throughout the country. The death-rate from syphilis in the principal towns is 1·16 per 10,000—a proportion only exceeded in Europe by Italy, where the deaths are in the ratio of 1·65 per 10,000. The "Radesyge," described under Norway, was endemic in Sweden during the past and at the beginning of the present century, but it seems now to have entirely disappeared.

Rheumatic Fever is frequently observed in all the provinces, but is most common in the northern districts.

CHAPTER IV.

DENMARK.

Geography and Climatology.—Denmark is situated between 54° and 57° 44′ N. lat., and includes the peninsula of Jutland and the islands of Seeland, Fünen, Laaland, Falster, Möen, Langeland, etc. The area in square miles is 14,553, and the population in 1887 was 2,109,200. Copenhagen, the capital, in 1888 had 300,000 inhabitants. These islands are generally flat, fertile, and carefully cultivated. Jutland was formerly covered with forests; since their destruction extensive districts have been converted into barren heaths and marshes.

The climate is mild and humid. At Copenhagen the mean temperature of the seasons is—spring, 43°·5 F.; summer, 63°·5 F.; autumn, 49°·3 F.; and winter, 32°·9 F. The prevailing winds are westerly; but in spring the cold, dry wind known as the *skai*, carrying clouds of sand, prevails.

The marriage, birth, and death rates per 1000 for the ten years ending 1887 were 15·0, 32·2, and 18·7 respectively. The quarterly death-rate in Copenhagen for 1888 was as follows:—

First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.
24·2	23·4	20·2	19·4

Pathology.—*Malaria.*—Rey states that malarial fever is only endemic in the low and marshy parts of the islands of Laaland and Falster.[1] At Copenhagen from 1843 to 1847, Hannover found intermittent fevers to form 30 per 1000 of the total admissions into the civil hospitals.

The proportion of deaths at the present day from malarial fevers is small, and is gradually diminishing. Yet, during this century, Denmark has suffered from excessively fatal epidemies, described as malarious. Thus, according to Lombard, 50,000 died of intermittent fever in Denmark between the years 1828 and 1832; the

[1] *Nouv. Dict. de méd. et de chirurg.*, Paris 1872.

islands of Seeland, Laaland, and Falster suffering most. In the island of Langeland, with 12,960 inhabitants, there were 2646 cases of this disease, and 200 deaths. This was part of the great epidemy of 1826–32 described by Haeser[1] as having extended from Christiania and Bergen in Norway to the Morea in Greece, and from Liefland to the Atlantic Ocean. Holland, Holstein, Schleswig, Jutland, and England were all more or less affected. It was known along the shores of the Baltic as the Küsten epidemy. In the middle part of Germany it was called the summer fever.

Haeser remarks that the most general effect of the epidemy was an increase of the mortality over a large part of Northern Europe. The year 1826, from which this epidemy dates, was one of the hottest within the memory of man.

From contemporary references to this epidemy in Rust's *Magazin*, it appears that the fever usually assumed the tertian type; the quotidian form was more rarely met with, and less frequently still the quartan. Dropsy and enlargements of the liver and spleen were frequent sequelæ of the disease. An earlier epidemy is referred to by Sir John Pringle[2] as having occurred at Copenhagen in 1652, marked by quotidian or tertian paroxysms, by bilious vomiting, and by the existence of spots which came out during the accessions and disappeared in the remissions.

From 1835 to 1848 intermittent fever had almost entirely disappeared from Denmark. The epidemy reappeared in 1848, but was much less fatal than the former one. From 1849 there has been no epidemy of this nature. It is remarked as a proof that the fever of 1828–32 was due to some telluric influence, that it did not affect the sailors who visited the ports and fiords unless they landed. It was clear also that the disease was non-contagious.

Typhoid Fever is met with in every part of Denmark in an endemic form, and as frequently recurring epidemies in particular localities. The mortality from typhoid and typhus fevers, the latter of extremely rare occurrence, attains an average of 385 per million living in the towns. In Copenhagen typhoid fever is rare, for from 1880–89 the deaths from typhus and typhoid fevers were in the ratio of 166 per million. The disease attains its maximum in the months of September, October, and November; the month most charged with deaths in a series of years being September.

Relapsing Fever is unknown in Denmark. *Cerebro-spinal Meningitis* appeared in 1845–48 as a widespread and somewhat fatal

[1] Haeser, *Geschichte d. Med.*, Jena 1882.

[2] *Observations on the Diseases of the Army*, Lond. 1775, p. 190.

epidemy among the civil population. In 1873–74 it broke out again, but was limited to a few localities in Jutland. Since that time Denmark has remained free from the disease.

Diphtheria and Croup cause an average death-rate (1881–84) of 628 per million. In Copenhagen the death-rate for the ten years ending 1889 was 547·0 per million.

Smallpox presses lightly on Denmark. Finsen, writing in 1874, states that he had not seen a single case within the previous ten years. The smallpox death-rate from 1881–84 is given as 0·08 per 10,000 persons living. In Copenhagen (1880–89) it was in the ratio of 3·7 per million (0·037 per 10,000). The narrow limits within which smallpox has been restrained in Denmark is partly owing, no doubt, to efficient vaccination, and partly also to careful isolation of all cases of the disease.

Measles and Scarlet Fever are endemic in the country, assuming an epidemic character from time to time. The death-rate from measles in Copenhagen for the ten years ending 1889 was 506·0, and that from scarlet fever during the same period, 303·0 per million.

Whooping-Cough is one of the most fatal diseases of childhood in Denmark. The average mortality for the period 1881–84 was 662 per million, and that of Copenhagen (1880–89), 506·0 per million; but it may readily be understood that the annual death-rates of a disease, so essentially epidemic in its character, varies widely, and that the averages drawn from a few years are not to be relied upon as indicating its prevalence. It would appear, however, that measles, scarlet fever, and whooping-cough are about equally fatal in Denmark and Great Britain.

Dysentery, which was common enough last century, is now one of the rarest diseases in Denmark; nor can *diarrhœa* be said to be specially frequent, although it causes a considerable mortality in the larger towns during the summer months. Copenhagen stands first in the order of mortality, the deaths averaging (1880–89) no less than 1660 per million from diarrhœal diseases.

Phthisis, including tubercular meningitis and tabes mesenterica, gives rise to an average mortality of 3042 per million,—a ratio very similar to that caused by phthisis in Sweden, less than that of the principal towns of Germany, but considerably in excess of that of England and Wales.[1]

Pneumonia is quite as common in Denmark as in the north of Europe generally. Hirsch gives the proportion of deaths in Copen-

[1] In 1876–83 the deaths from phthisis per 1000 living were 3·0 at Copenhagen, 2·63 for 5 of the largest towns, 2·27 for 24 medium towns, and 2·12 for 25 of the smallest towns. This shows the influence of density of population on the prevalence of phthisis.

hagen, founded on observations extending over seventeen years, as 1·7 per 1000 of the inhabitants. Of course the ratio will be less for the kingdom as a whole. Pneumonia attains its maximum in Denmark in the month of May. The cases are much more numerous in the spring (March–May) than in the winter season (December–February). The fewest cases occur in the month of August.

Bronchitis is much less fatal in Denmark than in many countries in the south of Europe.

Chlorosis, although less common than in Norway and Sweden, appears to have been increasing in frequency and gravity of late years.

Scrofula must be regarded as one of the most common diseases in Denmark. The deaths from scrofula form 6 per 1000 of the total mortality.

Syphilis gives rise to a death-rate of 0·94 per 10,000 of the inhabitants.

Diabetes is comparatively seldom met with.

Cancer is more fatal in Denmark than in any other European State, with the exception of Austria. The death-rate from cancer in the Danish towns reaches the high figure of 1098 per million living.

Rheumatic Fever gave rise to 4 per cent. of the admissions into Frederikshospital during a period of twenty-four years. The deaths from this disease are in the proportion of 4 per 1000 of the total deaths in Copenhagen, and 4·6 per 1000 in the other towns. The proportion in England from rheumatic fever and rheumatism of the heart is about 5 per 1000 of the total deaths. We may conclude from these figures that rheumatic fever is about as frequent in Denmark as in England.

CHAPTER V.

FINLAND.

GEOGRAPHY.—Finland extends between 60° and 70° N. lat., and between 20° and 32° E. long., its greatest length being 717 miles, with an average breadth of 185 miles. Its area is reckoned at 145,000 square miles, with a population of rather more than 2,000,000.

Finland is called by the natives *Suomenmaa, i.e.* the land of lakes and marshes; and it well deserves its name, for about 12 per cent. of the total area is occupied by lakes and 15 per cent. by marshes.

CLIMATOLOGY.—At Helsingfors, the capital, the mean annual temperature is 39° F., and that of summer 59° F. The coldest month is February, with an average temperature of 17° F.; while in July, the hottest month, the thermometer rises to 62° F. At Uleaborg, in 65° 1′ N. lat., the mean temperature of the year is 36°·5 F.; in winter it sinks to 14° or 15° F., and rises in July to 61° F. The winters in the eastern part of the country are extremely severe. The rainfall at Helsingfors averages 20 inches.

VITAL STATISTICS.—The death-rate is 27·0 per 1000. The mortality according to season is as follows:—Spring, 28·01; summer, 23·39; autumn, 23·22; winter, 26·38.

PATHOLOGY.—Hirsch states that "malarial fever is not endemic in Finland;" while, according to Lombard, it is the most common disease of the country, causing 18 per 1000 of the total mortality. This discrepancy is explained by the remarkable variation in the frequency and fatality of malarial fever in different series of years. Dr. Estlander, Professor of Surgery in the University of Finland, stated at the International Medical Congress at Philadelphia, that malarial fever was very common in Finland, particularly on the southern coast, at certain periods. This is what he says:—

"During the ten years 1850 to 1860 malarial fever raged there with great intensity; but from 1862 to 1868 it disappeared

so completely that not a single case was to be met with at the hospitals. From 1868 to the present time (1876) it has again attacked that part of the country very severely, but seems now to be fast decreasing." The causes affecting the prevalence of fever are stated as follows: "During the short summer the average stand of the barometer is high, the stand of the water is low, and the bottom of the sea is uncovered in the numberless small creeks and bays in the Gulf of Finland. No tide is perceptible there, and the bottom lies exposed in the sunshine, forming a rich source of miasmatic exhalations. When, on the contrary, the average stand of the barometer is low, all is covered with water, and the summer is rainy and cold, but free from fever. Typhoid fever is endemic, and mixed forms—typho-malarial—are met with in spring and autumn" (*Lancet*, 25th November 1876). It will be noticed that the epidemic period in Finland mentioned above nearly corresponds with that in Sweden.

In a return of diseases from thirty-three localities in Finland, I find 1003 cases of intermittent fever are recorded for the year 1889.[1]

Here is their monthly distribution:—

Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
98	87	95	139	138	91	99	46	68	67	40	35

It will be seen that the disease in Finland is vernal, a secondary rest taking place in autumn. The temperature in April, when the maximum is attained, is 32°·2 F. at Uleaborg; 33°·9 F. at Helsingfors, and 33°·6 F. at Kuopio. In other words, intermittent fevers are most prevalent in Finland when the temperature is about the freezing point.

Enteric Fever.—In the same year (1889) there were 639 cases of typhoid fever, which were distributed as follows:—

Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
20	27	18	17	34	20	76	131	75	79	87	55

We note here the absence of the April rise, which is so marked in the case of intermittent fever. The maximum prevalence of enteric fever occurs in August, but a marked rise is observed to take place in July, when the temperature is at its height. It seems as if a continuance for some time of a comparatively high temperature is necessary for the full development of the disease, which is thus more prevalent in August than in July.

Under the heading of *Gastric Fever*, *Remittent Fever*, and *Febricula*, 962 cases of disease are recorded. It is difficult to say if the fevers so classed are etiologically related to malarial or to typhoid

[1] *Finska Läkaresallskapets Handlingar*, Dr. Fagerlund, Helsingfors 1889.

fever, or if they form a class by themselves, and are independent of both as regards causation. We shall give the monthly distribution of this class of fevers :—

Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
100	104	94	107	77	74	64	43	52	73	96	78

Typhus is rarely met with.

Dysentery is rather common in Finland during the summer season. In all, 379 cases were noticed in 1889 in the localities referred to, and of these no fewer than 335 occurred from June to September.

This summer distribution of dysentery is also observed in Sweden, but not in Norway, when the maximum falls on the three months—September to November.

Diphtheria and *Croup* are frequent in Finland. Croup is endemic at Iakobstadt, which occupies a low and damp site on the Gulf of Bothnia (Hirsch). *Smallpox, Measles,* and *Scarlet Fever* occur in Finland as elsewhere in epidemies of varying intensity.

Pneumonia is common, and attains its maximum frequency in the months of February, March, April, and May.

In 1889, *Epidemic Influenza* broke out in November, when there were 506 cases recorded. It attained its maximum in December, when the number of cases recorded rose to 9560, and fell in January 1890 to 1676 cases. Under this influence, a marked rise took place in the prevalence of pneumonia and bronchitis.

Phthisis is said to be common in the larger towns, but to be less frequent in the country districts.

Scrofula, according to Lombard, is excessively common, especially in the northern districts.

CHAPTER VI.

RUSSIA IN EUROPE.

GEOGRAPHY.—Russia occupies that immense region stretching from the Arctic Ocean on the north to the Black Sea on the south, and from the Baltic on the west to the Ural Mountains and the Caspian on the east. On the south-west it is bounded by Germany, Austro-Hungary, and Roumania. It thus covers the larger part of the great plain of Europe.

Excluding Finland and the Caucasus, Russia has an estimated area of 1,923,503 square miles, and a population numbering about eighty millions.

The chief rivers are the Petchora, the Mezen, the northern Dwina, and the Onega, flowing to the Arctic Ocean; the Ural River and the Volga, into the Caspian; the Don, into the Sea of Azov; the Dnieper, Bug, Dniester, and Pruth, into the Black Sea; and the Neva, the western Dwina or Duna, and the Niemen, into the Baltic.

From the level nature of the regions through which these rivers flow, they are generally sluggish, sinuous, and liable to cause inundations.

Some account of local conditions as affecting the distribution of endemic diseases will be given in connection with the pathology of the several regions.

CLIMATOLOGY.—A country so extensive as Russia necessarily presents great variety of climate. The mean annual temperature of Archangel on the White Sea is 0°·4 C., while that of Baku on the Caspian is 14°·3 C. But the temperature in Russia is not determined by latitude only; longitude also has a marked influence on the thermometric means. The climate becomes more extreme as we pass from west to east. The summers are warmer, the winters colder, and the mean temperature of the year lower in the interior than at corresponding latitudes along the Baltic coast.

In order to simplify the study of the climate and pathology of a country which covers an area exceeding one-half of the continent of Europe, it will be convenient to divide Russia into four regions.

1. The Baltic Region. 2. The Northern Region, extending between latitude 60° N. and the Arctic Ocean. 3. The Central Region, lying between 50° and 60° N. latitude. 4. The Southern Region, between 40° and 50° N. latitude.

1. The Baltic Region.

The climate of this region is marked by a low annual mean temperature, severe winters, cold springs, warm summers, and by a high degree of humidity. The following table gives the mean temperature of the year (centigrade), and of the months of January, April, July, and October, at St. Petersburg in the north, at Dorpat in the central part of the region, but inland, and at Mittau, on the coast, in the south:—

Place.	Latitude.	Altitude (Metres).	Jan.	April.	July.	Oct.	Year.
St. Petersburg, .	59° 56′	10	−9·4	2·0	17·7	4·5	3·6
Dorpat, . .	58° 23′	70	−8·0	2·3	17·4	5·4	4·3
Mittau, . .	56° 39′	10	−5·0	4·9	17·6	6·9	6·1

The average amount of rainfall along the Baltic varies from 48 to 60 cm., according to locality, and its monthly distribution per cent. is as follows:—

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
5	5	6	6	8	9	12	12	11	11	9	6

2. The Northern Region.

That part of Russia situated north of the 60th parallel has an extremely rigorous climate. The winters are long, the country in the north being covered with snow from six to nine months. The summers are short, but moderately warm. We shall give the temperature at three stations, viz. Archangel, Petrosavodsk, and Ust-Sysolsk, as illustrating the climate of the north, south-west, and south-east of this region:—

Place.	Latitude.	Altitude.	Jan.	April.	July.	Oct.	Year.
Archangel, . .	64° 33′	10	−13·6	−1·1	15·8	1·4	0·4
Petrosavodsk, .	61° 47′	50	−10·4	0·8	17·0	3·6	2·2
Ust-Sysolsk, .	61° 40′	100	−15·2	0·3	16·5	0·5	0·3

3. The Central Region.

The climate of the Central region is characterised by great extremes. Cold winters, especially towards the east; warm summers,

the mean summer temperature increasing as we advance south and east. We shall give the temperature of Kostroma, Moscow, and Kursk for the central districts, from north to south; that of Kazan and of Saratov for the eastern districts; and of Kiev and Orenburg for the extreme west and east:—

Place.	Latitude.	Altitude.	Jan.	April.	July.	Oct.	Year.
Kostroma, . .	57° 47′	110	–11·8	1·8	19·0	3·8	3·1
Moscow, . .	55° 46′	160	–11·1	3·4	18·9	4·3	3·9
Kursk, . .	51° 45′	210	– 9·9	4·7	19·3	6·4	5·2
Kazan, . .	55° 47′	80	–13·8	3·2	19·6	3·7	2·9
Saratov, . .	51° 29′	90	–10·2	4·6	21·7	5·7	5·4
Kiev, . . .	50° 26′	180	– 6·0	6·7	19·1	7·6	6·8
Orenburg, . .	51° 46′	110	–15·3	3·2	21·6	3·8	3·3

The annual amount of rainfall varies from 35 to 50 cm.

4. The Southern Region.

The climate throughout this region is extreme, the winters are less severe than in the central governments, but the summers are excessively hot. The rainfall is scanty in many places in the east. At Astrakhan the average is about 12 or 13 cm. We shall give the temperature for Pultava and Sebastopol as representing the south-central districts, north and south; for Astrakhan, Stavropol, and Baku for the east and south-east districts.

Place.	Latitude.	Altitude.	Jan.	April.	July.	Oct.	Year.
Pultava, . .	49° 35′	140	–8·2	6·8	21·1	8·2	7·1
Sebastopol, . .	44° 37′	40	1·9	9·7	23·2	13·5	12·1
Astrakhan, . .	46° 21′	20	–7·1	9·4	25·5	10·0	9·4
Stavropol, . .	45° 3′	550	–4·1	7·8	20·9	9·7	8·6
Baku, . . .	40° 22′	0	3·4	11·1	25·8	16·6	14·3

Vital Statistics.—Lombard gives the birth-rate of Russia at 50·7 per 1000, which is higher than that of any country in Europe. The government of Saratov in the south-east has a birth-rate of 60 per 1000, while in many of the central governments the rate exceeds 50 per 1000. Wilna, Volhynia, and Archangel have the lowest proportion of births, the rate varying from 30 to 40 per 1000.

The marriage-rate is also high in Russia, especially in the provinces situated in the south-east and south-west.

The death-rate for the whole of Russia in Europe is estimated by Lombard at 35·4 per 1000. The mortality in Russia is thus nearly double that of Norway, and higher than that in any European country. The governments of Vologda, Perm, and Viatka show the highest mortality, and the next in order are Nijni-Novgorod, Moscow, Tula, Orel, and Voronez: in all of these the death-rate exceeds 40 per 1000. The death-rate is comparatively low in the

governments of Archangel, Lapland, Podolia, Taurida, and Ekaterinoslav.[1]

In the Baltic provinces winter and spring are the seasons of highest mortality; in the centre and south, summer is the most deadly season.

THE BALTIC PROVINCES—ST. PETERSBURG, ESTHONIA, LIVONIA, COURLAND, KOVNO.

PATHOLOGY.—*Malaria.*—The capital is built upon the delta of the Neva, occupying a site which was originally marshy, but which has now been drained, and either built over or laid out in gardens and meadows. The city of St. Petersburg is practically free from intermittent fever; it is, however, far from healthy, the average death-rate being 30·2 per 1000. Esthonia, Livonia, Courland, and Kovno are low and marshy. Malarious diseases are common throughout these provinces, although they do not, as a rule, assume here a grave form. Dorpat, an inland town of Livonia, is situated on the River Embach, which falls into Lake Peipus. The Embach is subject to overflow, which adds to the humidity of a soil already damp. This explains the frequency of malarious diseases in the town and neighbourhood. Riga, again, the chief town of the province of Livonia, situated on the Dwina, five miles from where it enters the Gulf of Riga, is subject to the paludal conditions similar to those of Dorpat, and suffers in the same way from intermittent and remittent fevers.

Typhoid Fever is endemic in St. Petersburg. It is, in fact, more fatal here than in any of the other great towns of Europe. The average death-rate from typhoid and typhus fevers for the five years ending 1889 was no less than 0·9 per 1000, the greater part of which mortality was undoubtedly due to typhoid fever. In 1885 the deaths from typhoid fever alone were 0·89, and in 1886 the ratio rose as high as 1·13 per 1000. The disease is most frequent in the first and second quarters, and least so during the third quarter. Typhoid fever is also met with, but to a less extent, in the other Baltic provinces. Typhoid fever is stated by Rey to have been epidemic in Dorpat in 1826 and in 1841; and in 1845–47 at St. Petersburg.

Diphtheria caused a death-rate of 0·47 per 1000 in St. Petersburg during the five years 1885–89. I have not met with any data for the other provinces; but I find that in the Prussian town of

[1] The death-rate of St. Petersburg (1885–89) was estimated at 30·2, that of Moscow (1888–9) at 38·2, and that of Warsaw (1886–87) at 27·6 per 1000.

Memel, which is on the frontiers of Russia, and geographically a part of Kovno, the average deaths from diphtheria and croup, in the two years 1887 and 1888, was 0·82 per 1000. It seems probable, therefore, that diphtheria is prevalent throughout these provinces. In the Baltic provinces of Russia, diphtheria attains its maximum in the first quarter.

Diarrhœa is an exceedingly prevalent and fatal disease in St. Petersburg; the mortality in the five years ending 1889 from diarrhœal diseases reached the enormous ratio of 4·41 per 1000.[1] There is this peculiarity about the disease in St. Petersburg, that it is by no means restricted to the warm months. In 1885 the maximum mortality took place in the third quarter; but the number of deaths in the first quarter (January to March) was also very high. In 1886 and in 1888 the deaths in the first, second, and third quarters were all excessive. In short, the causes of this disease in St. Petersburg are, to a greater extent than elsewhere, independent of high temperature.

Dysentery is by no means a fatal disease in the Baltic provinces generally, although it is somewhat prevalent at Dorpat and in a few of the more malarious localities. Dysentery was epidemic in these provinces, as well as in the west-central region, in the years 1845–46.

Cholera.—The Baltic provinces were visited by cholera in 1831, 1847, 1848, in 1852–53, in 1860, 1861, 1862, in 1866–67, 1869, 1871, and 1873. In 1852–53 the epidemy raged in winter, notwithstanding the extreme cold of that season in these provinces.

Typhus has been repeatedly epidemic in the Baltic provinces during this century. Although it is still endemic,[2] I have no data for determining its prevalence at the present time. From 1864 to 1869 the admissions for typhus into the Obuchoff hospital in St. Petersburg numbered 6789, while in the same period the admissions for typhoid were 3664. At the present day typhus is certainly much less frequent.

Relapsing Fever appeared in an epidemic form in the summer of 1864 at St. Petersburg, and in 1865 it broke out in Livonia. It was excessively common in St. Petersburg from 1864 to 1869, the cases being most frequent in the cold months, and not in the summer season, as in Glasgow and Edinburgh in 1843–44 and 1847.

Measles and *Scarlet Fever* are prevalent and fatal diseases in St.

[1] I take both the number of deaths and of the population from the Registrar-General's Annual Summary, but no great reliance can perhaps be placed upon the estimates of population. The figures are thus to be accepted as approximate only.

[2] Pushkarev, *Ejened. klin. gazeta*, 1884.

Petersburg; the average mortality from the former during the five years 1885–89 was 0·71, and from the latter 0·65 per 1000.

Whooping-Cough in the same period gave rise to a death-rate of 0·23 per 1000.

Influenza.—Russia has been the starting-point of many of the epidemics of influenza that have spread over Europe; and when it was raging in Russia, the Baltic provinces have never escaped the disease. The mortality during the epidemy of 1889–90 was very considerable.

Phthisis occupies a leading place among the fatal chronic diseases, and is perhaps as common as in Western Europe.

Of the prevalence of *Pneumonia,* Hirsch states that it occurs to a moderate extent, but not more frequently than in many other countries more to the south. It is said to be common in spring. I have met with no more precise information respecting *Bronchitis* than that it is common in the winter season in this region.

Pleurisy is by no means rare in St. Petersburg and throughout the Baltic provinces.

Leprosy exists along the coast from St. Petersburg to Riga. Bergman published in 1869 notes of 104 cases observed from 1861. Of these, 77 were natives of Livonia, 17 of Esthonia, 3 of Courland, and 7 of St. Petersburg. The province of Livonia is thus the headquarters of the disease. Dr. Wellberg had 24 cases under his care in the hospital at Dorpat from 1878 to 1884.

Syphilis, at the present day, is widely prevalent in the Baltic provinces both of Russia and Prussia. Up to about the middle of this century it was so general as to be justly regarded as endemic in Lithuania, which includes Livonia, Courland, Kovno, and East Prussia.

The Prussian Government had to establish special hospitals in the districts for the treatment of syphilitic patients.

Of 665 cases of syphilis which came under the care of Dr. Schnuhr from the 1st November 1835 to 1st November 1837, no fewer than 218 were cases of broad condylomata, affecting the hips, arms, thighs, labia, and scrotum; and in some cases the back, armpits, forehead, scalp, mammæ, or angles of the mouth; and 16 were in boys and 12 in girls under the age of fifteen years.

Primary ulcers of the throat and mouth occurred in 163 cases; of these, 15 were boys and 8 were girls under 15 years.

Secondary ulcers and broad condylomata of the mouth and throat occurred in 60 cases. Syphilitic diseases of the skin occurred in 30 men and 20 women; secondary ulcers of the extremities in 18 men and 20 women; affections of the bone in 24 cases. Primary

sores (chancres) on the organs of generation were met with in 48 cases, gonorrhœa and leucorrhœa in 28, and buboes in 6 instances.

"Condylomata," Dr. Schnuhr says, "were found in many cases, where, from minute medical examination, as well as medico-legal investigation, it appeared impossible to believe that any primary sore upon the organs of generation could have preceded their appearance. The tender age of many of the patients was in itself sufficient to rebut the idea of their being the result of sexual intercourse. Among the poorer classes whole families sometimes occupy the same bed, and in such cases it is by no means uncommon to find all the members of the family, from the grandfather to the infant, affected with condylomata in various parts of the body."

The peculiar features of the syphilis of Lithuania, according to Dr. Schnuhr, are (1) the excessively large number of cases of condylomata and ulcerated sore throats; (2) the occurrence of these two affections apparently as primary symptoms; (3) the frequent propagation of the disease by other means than by coition; (4) the comparatively rare occurrence of chancres; (5) the almost complete immunity of the lymphatic system; and (6) the rare occurrence of general lues, in spite of the frequent and great neglect of the primary affection.

This account of the endemic syphilis of Lithuania is not without interest. It seems to be widely different from the radesyge of Norway, and bears the closest possible resemblance to the *tety* of Madagascar.[1]

Scrofula is frequently met with.

Diabetes is exceedingly rare, at least in the capital.

The Northern Governments—Archangel, Olonetz, Vologda.

Pathology.—*Malaria* is little known in any part of this region. The few cases of intermittent fever occasionally met are restricted to the more marshy localities in Olonetz. Dr. Buchholz observed a considerable number of cases of tertian fever in 1856 in the district of Petrosavodsk on Lake Onega; and the cases must have been of some gravity, inasmuch as the deaths were in the proportion of one to forty-six treated. This, it should be remarked, was the period when malaria was epidemic in Sweden, and we may suppose that the epidemic influence made itself felt on the shores of Lake Onega, where, we are told, the disease, as a rule, is seldom seen.

Typhoid Fever is met with throughout the whole of these

[1] *Medicin. Zeitung*, 1837; *Med. Review*, July 1838.

provinces, extending even to the Kola peninsula, in the extreme north, where it has prevailed in an epidemic form amongst the Lapps inhabiting that region.

Typhus Fever is not a stranger in Northern Russia; but, so far as can be gathered from the very imperfect data at our disposal, neither typhoid nor typhus fever is so frequent in the north as in the centre and south of the empire.

Dysentery is not endemic in the northern provinces; but sporadic cases are met with in all the governments. In certain years the cases become so numerous in some districts that the disease may be looked upon as epidemic. We have no accounts, however, from this region of those destructive epidemics which have been witnessed in Sweden; but this may be owing to our ignorance of the medical history of Northern Russia.

Diphtheria.—To what extent diphtheria, which has been so prevalent in other parts of the empire, has established itself in the north, I have no means of knowing. *Croup* is of frequent occurrence in the northern governments.

Asiatic Cholera visited Archangel in the summer of 1831, and again in 1871; but apart from these outbreaks, the territory north of latitude 64° has been spared. The eruptive fevers—*Smallpox, Scarlet Fever,* and *Measles*—are met with, the two latter in epidemics recurring at irregular intervals; but none of them are specially prevalent in this region.

Bronchitis is one of the commonest maladies in North Russia, and pneumonia and pleurisy are also of frequent occurrence, especially in the governments of Olonetz and Archangel.

Phthisis forms an important factor among the causes of death in every part of this region. During the three years 1857–59 this disease caused 204 per 1000 of the deaths occurring in the civil hospitals in Vologda, 190 in those of Archangel, and 65 in those of Olonetz; while for the empire generally the proportion was 165 per 1000 (Lombard). It thus appears that phthisis is more fatal in the north of Russia, as a whole, than in the central and southern governments; and that, as respects the north, the western and, in parts, marshy government of Olonetz is that in which phthisis is least prevalent.

Scorbutus is, in a certain sense, endemic in the governments of Archangel and Olonetz. *Goitre* occurs both on the eastern and western shores of Lake Ladoga. *Leprosy* is unknown in the northern governments.

The Central Governments.

Central Russia, lying between the 50th and 60th parallels, comprises numerous governments, which may be arranged into three groups. (*A.*) The western subdivision includes the governments of Pskov, Vitebsk, Vilna, Grodno, Minsk, Mohilev, the kingdom of Poland, and Volhynia. (*B.*) The central subdivision comprises Novgorod, Jaroslav, Tver, Kostroma, Vladimir, Nijni-Novgorod, Moscow, Smolensk, Kaluga, Tula, Riazan, Pensa, Tambov, Tchernigov, Kiev, Orel, Kursk, and Voronez. (*C.*) The eastern subdivision comprises Viatka, Perm, Kazan, Ufa, Simbirsk, Saratov, Samara, and Orenburg.

Physical Features.—(*A.*) *Pskov* is not generally marshy, but contains numerous small lakes. *Vitebsk*, watered by the Dwina, is hilly, with extensive wooded plains, a considerable area being covered by marsh and lake. *Vilna* is generally flat; the highest elevation does not exceed 1000 feet. It is watered by the Niemen, and is studded with some four hundred small lakes. The south of *Grodno* lies in the basin of the Vistula, the north in that of the Niemen. Extensive morasses are met with in the southern districts. *Poland* generally is flat. The chief rivers are the Vistula and its affluents, which often overflow their banks and inundate large tracts of land. *Minsk* is to a great extent covered with woods and marshes. Amongst these are the Pinsk marshes, formed by the Pina and the extensive swamps in the course of the Beresina and the Pripet. *Mohilev* consists, for the most part, of a fertile plain, watered by the Dnieper and its tributaries. It has no great extent of marsh land. *Volhynia*, where it borders on Minsk, is marshy, but in the south it is hilly and well drained.

(*B.*) The central division, corresponding in part to the low plateau stretching south from the Valdai Hills, between the head waters of the Volga and Dwina on the north and those of the Don and Dnieper on the south, is, upon the whole, less marshy than the western region. Still, numerous lakes and marshes are met with in Novgorod, Moscow, Tver, Kostroma, and in other localities, while Jaroslav and Nijni-Novgorod are subject to inundations, producing temporary marshes which are by no means innocuous.

(*C.*) The plains of Kazan, Perm, Ufa, Simbirsk, and Samara are all subject to regular annual inundations of the Volga and the other large rivers, such as the Kama, Viatka, etc., which discharge into the Volga. During the inundations, vessels may be seen sailing over pastures and cornfields to reach the towns, which are here situated on heights. When the waters have withdrawn into their

accustomed channels, pools are left behind, where water stagnates for several months.

PATHOLOGY.—*Malaria.*—(*A.*) Intermittent fever prevails to a large extent in the western division of Central Russia. In the government of Vitebsk malarial fevers are frequently seen; in Pskov they are less common. In the inundated plains of Poland, fevers, sometimes of a pernicious character, are observed in summer and autumn. The vast marshes of Minsk render it one of the most malarious districts in the west. Frank, in noticing the prevalence of intermittent fever in Vilna, says that he has several times seen these fevers rage in the month of February, when the Réaumur thermometer marked 20° of frost and more, and when the marshes formed a mass of stony hardness from which no exhalations could be given off.[1] In Mohilev, Volhynia,[2] and Grodno, intermittent fever counts among the commonest of maladies. (*B.*) Malaria is endemic in the marshy districts of Novgorod. Moscow and its neighbourhood suffer in a minor degree. Here intermittent fever forms about one-seventh of the total diseases treated. Some districts in the Moscow government, such as Podolsk, are decidedly malarious. The governments of Vladimir and Nijni-Novgorod present numerous malarious foci. Jaroslav and Kostroma are more salubrious, but some of the inundated localities in the former are subject to fever. At Slöuta, in the Glückov district, and in other parts of the Tchernigov government, quotidian and tertian fevers are very prevalent. At Likhvin, in Kaluga, and in numerous localities in Tambov, Kursk, Kiev, and Voronez, malarial fevers are endemic. The other governments in this division suffer, but to a less extent. (*C.*) Malarial fever is endemic in many parts of Kazan, such as in Tchistopol,[3] and in Perm and Ufa after the inundations dry up. According to a writer quoted by Graves,[4] " Ufa is visited about that time by an intermittent fever, which attacks the patient every seventh day only, but is so violent that it generally proves fatal." In Samara intermittent and remittent fever formed almost the half of the cases treated by Dr. Ucke,[5] and they also form a large proportion of the cases treated in the military hospital of Orenburg. Simbirsk is also subject to the malarious influence; and in some places, as, for example, Sengilei, they are both frequent and grave.

We observe a gradual increase in the intensity of the disease as we advance from north to south. The quotidian type becomes

[1] Frank, *Traité path. intern.*, Paris 1838. [2] *Vrach*, 1884.
[3] Shidlovski, *Vrach*, 1883. [4] Graves, *Clinical Medicine.*
[5] *Das Klima und die Krankheiten der Stadt Samara*, Berlin 1863, quoted by Lombard.

more frequent, and in the more malarious localities in the southern parts of the central division remittent fever is of more frequent occurrence.

Typhoid Fever is endemic in all parts of Central Russia, but we have no means of ascertaining its relative prevalence in the several divisions and governments. At Warsaw the death-rate (1886–87) from typhus and typhoid was 554 per million, while the death-rate for the same diseases at Moscow (1888–89) was 404 per million.

Typhus Fever is both endemic and epidemic in this part of Russia. Its endemic seats, according to Hirsch, are "Poland and the government of Viatka, and the adjoining districts on the Volga." Typhus has frequently assumed an epidemic form in these governments during times of famine or of war.

Relapsing Fever has often been observed in various parts of Central Russia. It was epidemic at Moscow in 1840–41, in Novgorod and other districts in 1864, and in Poland in 1868.

Cerebro-spinal Meningitis has appeared from time to time in many of the central governments. In 1863 it was epidemic in the government of Kaluga; in 1865 and later, in Poland, Minsk, and Moscow.

Dysentery is not endemic in any of the central governments, but sporadic cases are met with in them all. Novgorod, Minsk, Mohilev, Moscow, Jaroslav are the governments in which the disease is of most frequent occurrence. It is interesting to note, as bearing on the etiology of the disease, that it appeared in 1857 in all localities where troops from the Crimea, amongst whom it was common, were stationed. Dysentery occasionally becomes epidemic in limited localities, but we do not read of extensive and fatal outbreaks of the disease in Central Russia such as those which have been witnessed in other countries. We have already noticed its extension to the western governments in 1845–46, when it was epidemic in the Baltic provinces.

Diarrhœa is more or less prevalent throughout this region during the summer season, especially in Moscow, Tula, and other large towns. The death-rate from diarrhœal diseases at Moscow in 1888–89 was no less than 9·12 per 1000 living, which is the highest rate of any town in Europe. Warsaw had also a very high death-rate from this class of diseases, the ratio in 1886–87 having been as high as 4·46 per 1000.

Asiatic Cholera has overrun every government in Central Russia during one or other of its numerous epidemic visitations. This region of Russia with which we are dealing has probably suffered

to a greater degree from cholera than any other part of Europe. In 1830–31 cholera raged from the eastern governments of Perm and Viatka to those of Minsk, Grodno, Vilna, and Volhynia on the west. No less widely diffused was the epidemy of 1847–48. In 1852, 1853, 1855, and 1859, many districts were visited once or oftener by the disease. Still more general was the diffusion of this pestilence from 1865–68. From 1869 to 1874 a series of most destructive outbreaks occurred, which proved excessively fatal in the central group of provinces in this region, especially in Tambov, Jaroslav, and Moscow. In these three governments the cholera mortality in 1871 averaged 6 per 1000 of the population. The later outbreaks, such as that of 1874, have been of small extent and less malignant.

Plague.—The central parts of Russia have not escaped the inroads of plague during past centuries. No later than 1770 it appeared at Moscow, and the close of the eighteenth century (1798) witnessed an outbreak of the disease in Volhynia. From that time Central Russia has been free from this pestilence, although, as we shall presently see, it has several times, during the present century, broken out in the southern governments.

Diphtheria appeared at Moscow in 1853, and since that date it has been frequently seen throughout this region. In 1888–89 diphtheria caused a mortality of 812 per million in Moscow, and of 864 in Warsaw. These figures no doubt include croup.

Croup is prevalent to a greater or less degree in all the central governments, especially in those of the western division.

The *Eruptive Fevers* appear to be moderately prevalent in Central Russia, but we have no means of comparing their frequency here with that in other countries. *Scarlet Fever* is stated to be exceedingly rare in Samara. As to *Whooping-Cough*, all we know is that it appears in epidemies in all parts of the empire.

Respiratory diseases are met with as frequently as in Western Europe generally. Pneumonia is stated by Boulgakoff to be frequent at Tchernigov. At Moscow respiratory affections are signalised as common, and at Samara pleurisy and pneumonia were found by Dr. Ucke to form nearly one-twentieth, and bronchitis and tonsillitis one-twenty-third, of all the cases treated.

Phthisis is less prevalent in Central Russia than in the north, but is considerably more common than in the south. The authorities quoted by Hirsch testify to its prevalence in Novgorod, Viatka, Kazan, and Kursk. It is also of frequent occurrence in Tchernigov and Orenburg; while in Samara, on the other hand, it is exceedingly rare.

Hepatic diseases are rare in the more northern governments, but they are of more frequent occurrence in the south. At Samara

diseases of the liver and spleen form 13 per 1000 of the diseases treated.

Scrofula prevails to a great extent throughout the centre of Russia, from the Baltic to the Urals.

Goitre is endemic in the hilly districts of Perm and Orenburg, and at one or two localities in other governments.

Leprosy is unknown.

Rheumatism and *Rheumatic Fever* are reported to be of frequent occurrence throughout this region.

Scorbutus is of not unfrequent occurrence, especially in prisons.

Plica Polonica, an affection of the scalp, in which the hair is matted together in tufts, sometimes forming an irregular cap-like mass, is endemic in the western division of Central Russia. The governments of Vitebsk, Grodno, Kovno, Minsk, and Volhynia are those in which the disease is most prevalent.

The Southern Governments.

That part of Russia in Europe lying to the south of the 50th parallel may be divided into four governmental groups. (*A.*) The south-western governments of Podolia, Bessarabia, Poltava, Kherson. (*B.*) The south-central governments of Kharkov, Ekaterinoslav, Taurida (Crimea). (*C.*) The south-eastern governments of Astrakhan, the Don Cossack country, and Novo Tcherkask. (*D.*) The Caucasian governments of Kuban, Stavropol, and Circassia.

Physical Features.—With the exception of the country bordering on the Caucasus, the whole of the governments within this region consist of low plains, through which the Volga, Don, Dnieper, Dniester, and other rivers flow on their way to the Caspian, the Sea of Azov, or the Black Sea. Some of the southern parts of Astrakhan are actually below the sea-level.

The Volga, for 300 miles from its mouth, flows through a level, treeless plain, the soil of which is sand or light clay strongly impregnated with salt and nitre. The left bank of the river is low, permitting it to break up into collateral streams connected by cross-channels, and intersected with shallow watercourses. The river begins to rise in the end of April, and continues rising until the beginning of June, flooding a belt of land ten miles broad. It then begins to subside, and regains its old level by the beginning of July.

The Don, in the same way, overflows its banks for miles when the ice melts, so that in many places the houses have to be raised on piles to prevent them from being submerged. The Dnieper, the Dniester, the Bug, and their tributaries are also liable to overflow

their banks; and extensive tracts of swamp and water-logged soil are formed along their course, especially in their lower stretches, where they flow through flat plains. Similar conditions are met with near the mouth of the Kuban, the Kouma, and the Tereck in the Caucasian provinces.

PATHOLOGY.—*Malaria* is endemic to a large extent throughout the whole of this region, exhibiting a higher degree of intensity than in the central governments. The remittent type here assumes greater prominence, although the intermittent, often of the quotidian type, is still that which is most frequently met with. The greater part of the mortality, however, is caused by autumnal remittents. The period of maximum fever prevalence differs from that of the northern and central regions. In the centre and north of Russia, as in Sweden, malarial fever is chiefly vernal; in the southern provinces it is autumnal, the fever season extending from August to November. This change in the period of the fever maximum is the result of the greater intensity of the malarial infection. The high summer temperature, combined with local conditions of soil found in this region, give rise to an infection sufficiently powerful to manifest itself at once in fever paroxysms of the remittent or quotidian type. Whereas in the north the temperature is low, the infection is less intense, and it is only after months of latency that it manifests its presence in the system by febrile phenomena during the cold and changeable spring months. It is difficult to believe that the malarial infection is contracted at the period when the fever manifests itself, when that period coincides with temperatures below the freezing point. It appears much more probable, for reasons which shall be given in the concluding chapter of this work, that the vernal fevers of cold countries are the manifestation of an infection dating from the previous summer or autumn.

When, therefore, Meyersohn states that he has observed intermittent fevers to prevail in the province of Astrakhan during winter, when the thermometer registered 20° of frost,[1] we are to look upon these paroxysms as the expression of an infection of the system contracted during the previous summer or autumn.

Malaria is general and intense in the government of Astrakhan, where the climatic and telluric conditions are highly favourable to its development. We need not wonder, then, that a German colony that attempted to settle in this province was decimated by fever.[2] Accounts are numerous of the prevalence of malarial fevers in Kharkov, Poltava, Ekaterinoslav, Kherson, and in many parts of

[1] Meyersohn, *Med. Ztg. Russ.* 1859, quoted by Hirsch.
[2] *Report of Plague Inquiry Commission,* Privy Council.

the Crimea (as, for example, in the valley of Inkermann), and along the swampy shores of the Sea of Azov. Bessarabia, as a whole,[1] but more particularly some districts, such as Bendery,[2] are extremely malarious. In few parts of the world is malaria more widely diffused than in the country north of the Caucasus. In Daghestan and Stavropol, both along the shores of the Caspian and inland, even at considerable elevations, fevers of a remittent type, and accompanied by cachexia, are of constant occurrence during the autumn, while the intermittent type is observed to prevail during the other seasons. Derbend and Temir-Khan-Shura in Daghestan, and the delta and banks of the Tereck, are noted haunts of fever.

Typhoid Fever is endemic in Southern Russia, and often assumes an epidemic form. As it is included with typhus in returns of disease, it is impossible to ascertain its relative prevalence in the several governments.

Typhus is frequently epidemic along the Russian shore of the Black Sea and in the Caucasus. Witness the extensive outbreaks of the disease among the troops during the Crimean war in 1854–56, by whom it was disseminated over a great part of Russia, and even to some extent in England. During the Russo-Turkish war of 1877–78, "the army of the Caucasus was decimated by typhus" (Hirsch). At Astrakhan, in 1862, typhus and typhoid fevers constituted 87 per 1000 of the diseases occurring among the marines. At Nikolaiev they formed 172 per 1000 of the total diseases and a large proportion of the deaths.[3]

Relapsing Fever has so frequently made its appearance at Odessa that we may regard it as endemic on the shores of the Black Sea.

Cerebro-spinal Meningitis was epidemic in the Caucasus in 1864, and in 1867–68 it spread over the whole of the Crimea. These epidemies are recorded by Hirsch, but I have not met with any reference to later outbreaks in this region.

Plague has found the conditions favourable to its outbreak and spread in this region, as is shown by the fact that it has repeatedly made its appearance in these governments after it had become an historic disease in most parts of Europe. A severe epidemy of plague, introduced from Turkey, and extending from Odessa to the Crimea and inland to Podolia, occurred in 1811. In 1828–29, and again in 1837, the disease was epidemic in Odessa. Its last appearance on European soil, and then only to a limited extent, was in the government of Astrakhan, in the winter of 1878–79, where,

[1] *Voyenno-sanit. dielo*, No. 14, 1885.
[2] *Russkaja Meditsina*, 1884.
[3] Lombard, *Traité de climatologie méd.*

after an absence of 70 years, it appeared in the valley of Vetlianka on the Volga, and a few other localities, causing about 600 deaths.[1]

Asiatic Cholera.—Astrakhan was the first point on European soil visited by cholera. This was in September 1823, during its first pandemic outbreak; and it was again through Astrakhan that this pestilence penetrated into Russia in 1830, and from Russia spread to the rest of Europe and America. The third pandemic invaded Europe in 1847 through Astrakhan and Odessa; and during these or the succeeding outbreaks, to which we have already referred, the whole of this region has paid its tribute to this pestilence.

Diphtheria appeared in Podolia in 1869, having been introduced from Roumania. From Podolia it spread over a great part of this region, causing a terrible mortality. It still prevails widely throughout this part of the empire.

Dysentery and *Diarrhœa* are endemic in Southern Russia, especially in the Caucasus.

Smallpox is more prevalent in the southern governments than in any other part of the empire. The other eruptive fevers are also met with, but we have no data for estimating their prevalence.

Bronchitis, Pneumonia, and *Pleurisy* are far from rare. In Astrakhan and Nikolaiev they formed, along with croup and diphtheria, 91 and 87 per 1000 respectively of the total treated.

Phthisis is decidedly less frequent in the south than in the centre of Russia. The statistics of the military hospitals of the Caucasus, published by Lombard, seem to prove that the disease is comparatively rare in this part of the empire.

Diseases of the liver and spleen are of frequent occurrence in the provinces bordering on the Black Sea and in the Caucasus.

Scrofula is met with in all parts of the south, and is said to be very common in Odessa and Astrakhan; but it is upon the whole less prevalent in the southern than in the central and Baltic provinces.

Goitre is endemic in various localities in the Caucasus.

Leprosy is still met with in the Crimea, along the shores of the Sea of Azov, at Astrakhan and Jaik, and amongst the Ural Cossacks (Lombard), and in the Caucasian provinces.

Syphilis is excessively common in some of the southern governments, such as Astrakhan, Kiev, Poltava, and Podolia.

[1] Netten Radcliffe, *Practitioner,* vol. xxvii. p. 67.

EUROPE.

DIVISION II.

CENTRAL AND WESTERN EUROPE.

CHAPTER VII.

GERMANY.

Geography.—Germany comprises an aggregate of twenty-six States, occupying the north-west of Central Europe. It stretches from the North Sea and Baltic on the north to the borders of Switzerland and Austro-Hungary on the south, and is bounded by Holland, Belgium, and France on the west, and by Russia on the east. The area of the whole empire is 211,168 square miles, with an estimated population, in 1887, of 47,580,000. Prussia has an area of 136,073 square miles, with a population, in 1887, of 28,700,000. Bavaria has an area of 29,632 square miles, with a population, in 1885, of 5,420,199. Saxony, with an area of 5856 square miles, had 3,249,000 inhabitants in 1887. Wurtemberg has an area of 7619 square miles, and a population, in 1885, of 1,995,185 souls. The Grand Duchies, Duchies, Principalities, Free Towns, and the Reichsland of Alsace-Lorraine have a combined area of 31,988 square miles, with an aggregate population of 8,210,801. Berlin, the capital of Prussia and of the empire, had a population of 1,438,000 in 1888; Hamburg, 550,694; Dresden, 259,142; Breslau, 313,451; and Munich, 275,000 inhabitants.

The northern part of Germany is a continuation of the vast plain of Russia and Poland, which extends along the Baltic and North Sea to Holland. The central and southern regions consist of a table-land, ranging from 500 to 2000 feet above the sea-level, broken by ranges and groups of mountains rising in the Noric Alps of Bavaria to a height of 9665 feet.

The soil of the plains is, for the most part, light and sandy, with tracts of peat interspersed. Moors and heath occupy a considerable area in Hanover and Lüneburg. The higher lands are generally fertile, and the country, as a whole, is well cultivated.

The chief rivers are the Vistula and Oder, flowing into the Baltic; the Elbe, the Weser, the Ems, and the Rhine, running into the North Sea; and the Danube, which, rising in the Black Forest in Baden, runs through Wurtemberg and Bavaria in German territory on its course to the Black Sea. The country on the Baltic lying between

the Niemen and the Vistula, as well as Pomerania and Mecklenburg, are dotted over with numerous small lakes. The littoral of the Baltic and North Sea, as well as the banks of the rivers in the lower part of their course, and the margins of the lakes, are in many places swampy. The interior is generally well drained, and presents only very limited areas of marshy soil in the river valleys.

CLIMATOLOGY.—The temperature over Germany does not present the diversity that the extent of the country might lead us to expect. The vicinity of the ocean on the north mitigates the cold, while the higher altitude of the interior modifies the heat which its more southern latitude would otherwise possess.

The following table, after Hann, gives the mean temperature centigrade of various localities in the north from east to west, and in the eastern, the central, and the western districts from north to south :—

Place.	Latitude.	Altitude (Metres).	Temperature. Jan.	April.	July.	Oct.	Year.
NORTHERN STATIONS, EAST TO WEST.							
Danzig,	54° 21′	22	−1·5	6·4	17·9	8·8	7·6
Stettin,	53° 26′	42	−1·5	7·4	18·1	9·2	8·3
Hamburg,	53° 33′	20	−0·4	7·6	17·3	8·9	8·5
EASTERN STATIONS, NORTH TO SOUTH.							
Bromberg,	53° 7′	52	−2·8	7·0	18·1	8·2	7·5
Posen,	52° 25′	82	−2·6	7·4	18·4	8·8	7·9
Breslau,	51° 7′	147	−2·2	7·9	18·5	9·4	8·3
CENTRAL STATIONS, NORTH TO SOUTH.							
Berlin,	52° 30′	48	−0·8	8·4	18·8	9·7	9·0
Leipzig,	51° 20′	119	−1·2	8·3	18·0	9·0	8·5
Nuremberg,	49° 27′	316	−2·8	8·1	17·8	8·6	7·9
Munich,	48° 9′	528	−3·0	7·6	17·3	8·3	7·5
WESTERN STATIONS, NORTH TO SOUTH.							
Crefeld,	51° 20′	45	0·8	8·7	18·2	9·8	9·3
Trier (Treves),	49° 46′	150	1·1	9·5	18·5	10·1	9·7
Strassburg,	48° 34′	144	−0·3	9·8	19·2	10·1	10·2

The mean rainfall of the whole country is estimated at 71 cm., or 28 inches. The coast line and the mountains have the heaviest, while Silesia and Rhenish Bavaria have the scantiest rainfall. The months of June, July, and August are, throughout the whole country, those in which the rainfall is heaviest.

VITAL STATISTICS.—The marriage, birth, and death rates for the whole empire for the ten years ending 1887 were 15·3, 37·4, and 25·7 respectively. In Prussia the average death-rate (1881–87) was 25·2; in Saxony (1885–87) it was 28·6; in Bavaria (1885) it was 29·5; and in Wurtemberg (1885–88) it averaged 26·2 per 1000.

The maximum mortality in Germany falls on winter and spring, —the prolonged cold giving rise to a higher mortality than the heats of summer. This rule does not apply to the large towns, in many of which the mortality is estival, as will be seen by the following table, giving the mean quarterly death-rates per 1000 for five of the most important cities:—

City.	Period.	First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.
Hamburg, . .	1885–88	28·1	26·6	25·9	27·8
Berlin, . .	1881–88	23·1	25·6	30·4	22·3
Breslau, . .	1885–88	28·7	30·7	32·5	26·5
Dresden, . .	1881–88	24·7	24·6	26·4	22·1
Munich, . .	1881–88	30·7	33·7	32·1	27·3

Pathology. — *Malaria* at the present day occupies a very subordinate position in the pathology of Germany compared to what it held in the last century. In many localities in which it was formerly common and severe, it is now either unknown or rare. Griesinger, for example, says that intermittent fever was wont to rage with great intensity at Mannheim, where it is now almost unknown; and Hirsch informs us that pernicious malarial fever was prevalent, as late as the eighteenth century, in the Hartz, in Augsburg, Saxony, Silesia, and Wurtemberg, where it now occurs only in occasional epidemies, and in its mildest forms. This great decrease in the prevalence of malaria throughout the empire is chiefly to be ascribed to the draining, and to the more extended and careful cultivation of the soil which has been in progress during the present century. It would be interesting, however, to know whether a similar, or at least a certain, diminution in the prevalence and intensity of malarial fever has not, at the same time, taken place in localities where such improvements have not been carried out.

That the decrease in the prevalence of malaria is still going on, will be seen from the yearly diminishing proportion which the cases of malarial fever in the hospitals bear to the total treated, as exhibited in the following table:[1]—

Year.	Ratio of Cases of Malarial Fever per 1000 of total treated.	Year.	Ratio of Cases of Malarial Fever per 1000 of total treated.
1877, . . .	12·3	1882, . . .	7·2
1878, . . .	10·7	1883, . . .	5·8
1879, . . .	9·6	1884, . . .	4·7
1880, . . .	9·7	1885, . . .	4·1
1881, . . .	9·2		

[1] *Arbeiten aus dem Kaiserlichen Gesundheitsamte*, Berlin 1888.

The relative prevalence of malaria in the principal divisions of the empire is shown in the following table, giving, for three recent years, the ratio of cases of intermittent fever per 1000 of the total cases treated in the public hospitals:—

Mean Proportion of Cases of Intermittent Fever per 1000 of all Diseases treated, 1883–85.

Prussia,	6·7	Oldenburg,	14·5
Bavaria,	3·2	Brunswick,	2·7
Saxony,	0·8	Saxe-Weimar,	0·6
Wurtemberg,	0·5	Anhalt,	1·6
Baden,	0·9	Lubeck,	5·9
Hessen,	1·2	Bremen,	6·5
Mecklenburg-Schwerin,	5·1	Hamburg,	5·1
Mecklenburg-Strelitz,	7·8	Alsace-Lorraine,	3·7

It will be seen from this statement that malaria can only be said to be at all extensively endemic on the plains, the higher lands in the interior being very slightly affected. Oldenburg, with its marshes, fens, moors, and lakes, is the most malarious State in Germany; while Wurtemberg, with its upland terraces,—the lowest of which is 400 feet above the sea-level,—is the State in which malaria is at its minimum.

Having shown the distribution of malaria as regards the States composing the German Empire, we shall now trace its incidence on the different provinces of Prussia.

Mean Proportion of Cases of Intermittent Fever per 1000 Cases of all Diseases treated, 1883–85, in the several Provinces of Prussia.

East Prussia,	12·7	Prussian Saxony,	3·4
West Prussia,	21·4	Schleswig-Holstein,	7·0
Berlin,	2·7	Hanover,	5·9
Brandenburg,	14·0	Westphalia,	3·6
Pomerania,	8·0	Hessen-Nassau,	0·8
Posen,	27·7	Rhine Province and Hohenzollern,	1·1
Silesia,	8·0		

The principal endemic seats of malaria in Prussia are thus seen to be Posen, West Prussia, Brandenburg, and East Prussia.

Speaking generally, malaria in the plains of North Germany is found to be endemic in the basins of the Vistula, the Warta (Werthe), the Oder, the Elbe, the Weser, and the Ems, and in the low-lying marshy tracts, such as the Ditmarsh, which stretches along the German Ocean from the Eider to the Elbe.

In the interior, intermittent fever is only met with, and, as a rule, in a mild form, in some water-logged valleys, along the marshy banks of rivers, in tracts subject to inundations, and in the basin-like depressions among the mountains of the Lower Rhine.

The nature of the local conditions of soil which are associated with malaria in the interior of Germany is well illustrated in the

case of Saxony. The kingdom is divided into four circles: Bautzen, Dresden, Leipzig, and Zwickau. Saxony, as we have seen, is little subject to malarious influences. Bautzen, however, to some extent forms an exception to this rule. Reinhard thus describes the medical topography of the malarious locality: "Immediately to the north of the town of Bautzen stretches a marshy tract traversed by tributaries of the Spree, which give rise to inundations twice a year, after the melting of the snow in the mountains, and, again, in the middle of summer. There are, besides, numerous ponds for carp, the rearing of which forms an important industry. The land, in some places, is covered with water for several years for the purpose of fish-breeding; then it is allowed to dry up for a series of years for the purposes of agriculture." This district, Reinhard says, has been subject to malaria from time immemorial. Comparing the mortality of this district with that of the adjoining mountainous country, this observer found the annual mortality on the hills to be 21·8, and that on the plains to reach 29·8 per 1000.[1] Outside this district ague is almost entirely confined to a few localities on the banks of the Spree, Lobau, and Parthe.

In Bavaria, malaria is almost entirely restricted to the damp valleys of some of the tributaries of the Danube. A certain number of cases is also met with at Bamberg (Lombard), situated on the banks of the Regnitz near its confluence with the Maine.

The environs of Tübingen in Wurtemberg must be to some extent malarious, as they furnished Griesinger with 409 cases of intermittent fever between the years 1854 and 1860.

The altitudinal limit of malaria in Germany, according to Hirsch, may be placed between 400 and 500 metres above the sea-level.

Malarial fever in Germany is a disease of the country rather than of the towns. Thus, while the cases of fever in Berlin formed only 2·7 per 1000 of the total treated, the proportion in Brandenburg, the province in which Berlin is situated, reached 14·0 per 1000. The existence of paludal conditions in or near a town, such as ditches or moats, may, however, render a town unhealthy. The towns of Julich, Bartscheid, and Aix-la-Chapelle were said to owe their insalubrity in past times to this cause. Endemic malaria is observed to assume epidemic proportions under two sets of conditions, viz. disturbance of the soil, and the inundation of level tracts of land.

The influence of excavations in causing outbreaks of fever was shown in the sickness which affected the neighbourhood of Jahde (1859–69) while the harbour was under construction. At the height of the local epidemy consequent on the excavations, about

[1] *Year Book*, Sydenham Soc., Lond. 1852, p. 500.

two-thirds of the population were attacked within a month. As the newly upturned ground settled down, the fever gradually diminished in prevalence. When the disease was at its height, Wenzel found the quotidian type, and the fevers approaching the continued form, to become relatively more frequent.

In the year 1854 malarial fevers became epidemic in some parts of Silesia after an overflow of the Oder; and this outbreak must have been of a severe character, inasmuch as it furnished Frerichs with the 45 cases illustrative of pigment liver which he details in his classical work on the diseases of that organ.

Such local exacerbations of endemic malaria must be distinguished from true epidemic malaria, which is not localised in endemic areas, and cannot be traced to local conditions.

Let us now briefly examine the seasonal distribution of malarial fever in Germany.

The following table gives the monthly percentage of cases of malarial fever occurring in different regions of the empire. It will be seen that in the Ditmarsh and at Jahde, where the malarious influence is more intense than in Germany generally, there are two maxima, the principal one occurring in autumn; while in Leipzig and Tübingen, where the infection is less severe, the fever is vernal or estival:—

Monthly Percentage of Cases of Malarial Fever in Germany.

	Ditmarsh.[1]	Jahde.[2]	Leipzig.[3]	Tübingen.[4]
January, .	2·87	4·42	1·26	0·98
February, .	3·07	4·51	2·20	1·47
March, . .	7·10	4·77	6·35	5·65
April, . .	10·84	5·28	14·74	18·43
May, . .	11·45	5·28	24·00	31·20
June, . .	7·10	4·94	21·20	22·35
July, . .	4·72	4·94	12·60	10·82
August, . .	17·14	14·39	8·20	3·68
September, .	19·11	18·30	5·38	3·19
October, . .	8·64	16·65	1·85	0·98
November, .	4·84	10·66	1·17	1·23
December, .	3·07	5·90	0·85	0·00

It has been stated that malarial fever is more severe in warm than in cold seasons, and particular instances are not wanting of warm summers having been specially malarious. The summer of

[1] Dose, from observation of 6896 cases, 1842–63 (Hirsch).

[2] Wenzel, cases occurring among harbour labourers, 1860–69.

[3] Thomas, twenty-three years' observations.

[4] Griesinger, 407 cases observed between 1854–60.

1868, for example, was an exceptionally warm one, and intermittent fever prevailed to an unusual degree, not only in the marshy districts of the Elbe, but all along the Dutch and German coasts of the North Sea. To what extent, however, the prevalence of autumnal fevers in Germany is regulated by the summer temperature is uncertain.[1]

Dry years are, as a rule, more unhealthy than wet ones in fenny localities. This, at least, has been observed to be the case in the Ditmarsh region. It is probable that rainy years are the most malarious in non-marshy districts.

The character of malarial fever, as met with in Germany, is generally benign. I find only 15 cases of death recorded in Prussia in 1882 out of 2984 patients under treatment in general hospitals. The pernicious forms are chiefly met with in level districts subject to inundation. Dr. Burdon Sanderson, who visited the region comprising the basin of the Vistula in 1865, states that to be exposed for a few hours on the banks of one of the canals in the Niederung, at the fall of the year, is sufficient to insure an attack of fever, the cases occasionally assuming a pernicious character.[2]

The tertian type is that which is most frequently met with in Germany. The proportions per cent. of the different types observed in the Holstein marshes are:[3]—

Tertian,	51·0	Duplicated Quartan,	2·4
Quartan,	26·1	Pernicious Fever,	0·3
Quotidian,	20·5		

Apart from local outbreaks due to the special causes to which we have referred, Germany has repeatedly suffered from the wider epidemies of malaria that have at intervals spread over extensive regions in Europe. During these visitations the disease has extended to districts where ague is not endemic. Thus it broke out in 1826 at Stuttgart, and again in 1834, both there and at other high and dry places in Wurtemberg which are not subject to the endemic form.

Malarial fever has also exhibited periods of activity and latency in particular localities which deserve notice. Hirsch informs us that at Königsberg "malarial diseases were scarcely at all observed from 1811 to 1825; but that after that an epidemy developed which lasted until 1833. From 1833 to 1841 the disease occurred in isolated cases only. From 1841 to 1852 it appeared every year in the spring to a moderate extent; but from 1852 to

[1] Virchow's *Archiv*, 1869.

[2] *Privy Council Reports*, 1865, p. 267.

[3] Dose, quoted by Hirsch.

1855 it was prevalent to an extent and with a severity but rarely seen in so high a latitude."

It is recorded that intermittent fever disappeared entirely from Marienwerder (where it is generally rife) on the cessation of cholera in 1831, and only reappeared with the return of cholera in 1849. This time, however, it did not disappear with the cholera as in 1831, but remained the predominating sickness in that locality up to 1856, when malarial fever again diminished in frequency.

No satisfactory explanation can at present be given of these epidemic extensions of malaria, of the remarkable fluctuations in the prevalence of the infection in particular localities, or of the relation of malaria to cholera such as was observed at Marienwerder.

Enteric Fever occupies by no means an insignificant place among the causes of death in Germany. The average death-rate for the period 1881–87 was 406 per million living, in Prussia; and in Saxony, from 1876–85, the ratio was 280 per million. I do not have the figures of mortality for Bavaria, Wurtemberg, and Baden, but, as we shall presently see, the ratio of typhoid sickness for these States does not exceed that of Saxony.

The typhoid death-rate of the principal towns of Germany (1881–84) was 356 per million, which is considerably in excess of that of London, where, from 1871 to 1880, it averaged 240 per million.

The typhoid death-rate of Germany, however, has been undergoing a marked decrease during recent years. In Prussia this decrease will be seen by the following figures, showing the death-rate from typhoid fever per million living from 1881 to 1887:[1]—

Years, . .	1881	1882	1883	1884	1885	1886	1887
Death-rate, .	544	488	453	443	340	314	264

In Saxony the death-rate from enteric fever from 1876 to 1880 was 301; while from 1881 to 1885 it had fallen to 260 per million. In 1886 it was 209; and in 1887 it sank to 162 per million.

No doubt much of this diminished prevalence is to be ascribed to the measures of sanitation which are being actively carried out, especially in the more important towns; but enteric fever, like other infectious diseases, has its cyclical periods of increase and decrease, and it would seem that the last decade has been one of diminished typhoid intensity.

The relative prevalence of enteric fever in the several divisions of the empire no doubt varies considerably in different series of years; but the following table, giving the average number of cases of typhoid and gastric fevers treated in the public hospitals per 1000

[1] *Preussische Statistik* for 1886 and 1887, Berlin.

treated for all diseases, will indicate approximately the distribution of the disease in Germany during the three years 1883–85 :—

Prussia,	37·7	Oldenburg,	49·2
Saxony,	25·9	Brunswick,	32·8
Bavaria,	25·5	Saxe-Weimar,	29·8
Wurtemberg,	16·0	Anhalt,	53·1
Baden,	23·4	Lubeck,	18·4
Hesse,	17·1	Bremen,	16·6
Mecklenburg-Schwerin,	36·9	Hamburg,	31·9
Mecklenburg-Strelitz,	49·2	Alsace-Lorraine,	35·6

Typhoid fever during these three years was evidently more prevalent in Prussia, Mecklenburg, Anhalt, and Oldenburg than in the middle and southern States, such as Saxony, Bavaria, Wurtemberg, Baden, and Hesse, and it will be observed that districts such as Oldenburg, in which malaria is prevalent, enjoy no immunity from enteric fever.

Lombard refers to the researches of Dr. Zuelzer, which show that the mortality from typhoid fever was higher in the towns of the south than in the north of Germany. At the present day the north of Germany appears to pay a much heavier tribute to typhoid fever than the south. Nor, if we restrict our attention to the mortality in the towns, will the result be different.

I take from Dr. Billings' Report on the Census of the United States the following figures, giving the typhoid death-rate per 10,000 living of some of the more important towns in Germany for the five years 1878–82, which I have arranged into four geographical groups, from north to south and from west to east, for the sake of comparison :—

Northern Coast Towns.	North Inland Towns.	Interior Towns.	Southern Towns.
Bremen, 1.1.	Hanover, 2·6.	Cologne, 2·9.	Strassburg, 3·6.
Hamburg, 2·7.	Magdeburg, 2·8.	Elberfeld, 5·0.	Stuttgart, 1·8.
Königsberg, 6·7.		Düsseldorf, 3·1.	Nuremberg, 2·4.
Danzig, 2·2.		Barmen, 3·7.	Munich, 5·0.[1]
		Frankfort O.M., 1·8.	
		Leipzig, 2·5.	
		Chemnitz, 2·9.	
		Dresden, 1·8.	
		Breslau, 3·5.	

These figures certainly do not show any progressive intensity of enteric fever from north to south; the highest death-rate occurs in the northern town of Königsberg. If latitude has any influence at all upon the distribution of enteric fever in Germany, it is entirely obscured by the preponderating influence of local conditions.

Having glanced at the general distribution of typhoid fever in

[1] Munich is built on a sandy soil, and is provided with cesspools, from which more than 90 per cent. of the contents soaked into the ground. This may help to explain the prevalence there of typhoid fever and also of diarrhœal diseases.

Germany, we shall now examine its relative prevalence in the different provinces of Prussia. The following table gives the proportion of cases of typhoid and gastric fevers per 1000 hospital cases for the three years 1883–85; and for the two succeeding years (1886–87) the ratio of deaths from enteric fever in the same provinces per 1000 deaths from all causes. This gives a comparable statement of the morbidity and mortality of typhoid fever in the various provinces of Prussia for five consecutive years. We add the ratio of typhoid deaths per 1000 of the total mortality of the principal towns for 1886–87:—

Province.	Ratio of Cases Typhoid and Gastric Fever to Total treated, 1883–85.	Ratio of Typhoid Deaths per 1000 Total Mortality, 1886–87.	Towns.	Ratio of Typhoid Deaths per 1000 Total Mortality, 1886–87.
East Prussia, . .	40·7	14·3	Berlin, ...	7·1
West Prussia, . .	47·6	15·7	Breslau, ...	5·5
Berlin, ...	21·9	7·1	Cologne, ...	5·4
Brandenburg, . .	32·4	10·7	Frankfort O.M., .	5·0
Pomerania, . . .	60·2	12·5	Königsberg, . .	12·7
Posen, ...	47·2	15·9	Magdeburg, . .	12·3
Silesia, ...	44·1	8·9	Hanover, . . .	5·1
Prussian Saxony, .	48·5	12·0	Dusseldorf, . . .	6·7
Schleswig-Holstein,	35·1	11·2	Danzig, ...	8·8
Hanover, . . .	25·8	12·6	Elberfeld, . . .	9·6
Westphalia, . .	49·8	12·2	Altona, ...	21·8
Hessen-Nassau, .	28·0	9·2	Barmen, ...	7·1
Rhine Province, .	33·1	10·7	69 Towns with a population between 20,000 and 100,000,	11·9
Hohenzollern, . .		8·0	1199 Towns with a population of 20,000 and under,	12·9

It will be seen from the above table that, during the five years 1883–87, typhoid and gastric fevers were most prevalent in East and West Prussia, in Pomerania and Posen, and least prevalent in Hessen-Nassau, the Rhine Province, and in the southern detached province of Hohenzollern. The mortality from typhoid fever was greatest in East and West Prussia, in Posen, and in Pomerania. The towns of Königsberg, Magdeburg, and Elberfeld, which appeared at the earlier period, viz. 1878–82, to be particularly subject to typhoid fever, are seen to maintain their former character. The typhoid death-rate of the provinces is affected by the occasional outbreak of local epidemies, such as that which evidently occurred in the town of Altona in 1886–87; but, apart from these local outbursts, the normal prevalence of typhoid fever is probably pretty uniform in certain areas. Local insanitary conditions may be assumed to go a good way in keeping up the persistently high mortality from typhoid fever in Königsberg; but, apart from the

presence of such exceptional local typhoid haunts, we observe a fairly uniform incidence of the disease all along the low, humid coasts of the Baltic, in East and West Prussia, Pomerania, Mecklenburg, and Oldenburg, and also inland, in the marshy plains of Posen. In all these districts the normal typhoid tension, if we may so speak, is high, and it readily breaks out into destructive epidemics. The better drained regions of Hessen-Nassau, Saxe-Weimar, the Rhine Provinces, and Alsace-Lorraine, although liable to epidemic outbreaks in special localities from time to time, do not appear to have the high normal typhoid prevalence which characterises the coast region.

Enteric fever is somewhat more fatal in the country than in the town districts of Prussia. In 1886–87 the ratio of deaths from enteric fever to the deaths from all diseases was 11·3 per 1000 in the towns, and 11·6 in the country.

Typhoid fever is least fatal in the largest towns with a population over 100,000. By referring to the table given above, it will be seen that in the four largest cities, Berlin, Breslau, Cologne, and Frankfort, the typhoid deaths form from 5 to 7 per 1000 of the total mortality; whereas in the towns with a population of from 20,000 to 100,000 they form 11·9 per 1000; and in the small towns, having 20,000 and less inhabitants, the proportion is 12·9 per 1000.

The same rule holds as regards Saxony, where, in the years 1886 and 1887, the deaths from enteric fever in the great towns were in the proportion of 167, and in the rest of the country of 193, per million living.

Typhoid fever attains its maximum prevalence and fatality in autumn in most parts of Germany, and generally either in the month of September or October. Here is the seasonal distribution per cent. of typhoid deaths in Berlin, Breslau, and Stuttgart, according to the figures published by Hirsch:—

	Spring.	Summer.	Autumn.	Winter.
Berlin, ...	18·1	24·5	36·5	20·9
Breslau, . . .	20·2	25·6	30·7	23·5
Stuttgart, . . .	21·8	21·7	26·9	29·6

In Berlin and Breslau the months of September and October are those most charged with typhoid deaths; in Stuttgart the maximum typhoid mortality occurs in November and December. The months of May and June are those in which enteric fever is at its minimum.

One notable exception to this autumnal prevalence of typhoid fever in Germany has to be noticed. At Munich the season is not only different from, but, as regards the period of the minimum,

just the reverse of, that obtaining in Germany as a whole. At Munich the maximum of deaths (1852–68 and 1873–79) falls on February, and the minimum in September or October. The reason of this departure from the usual period of typhoid prevalence has given rise to much discussion.

Typhoid fever is seen, in most places, to follow at a certain interval the heats of summer; and Liebermeister suggests that at Munich the same rule holds good, only that the retardation is greater there than elsewhere in Germany, on account of the breeding-places of typhoid fever in Munich lying deeper than at Berlin and other places. The maximum temperature of the earth at a depth of 4 metres is reached, according to the researches of Forbes, two or three months later than the maximum surface temperature. If, therefore, the localities where the fever poison is developed are situated deeper in the earth at Munich, this, it is held, would explain the retardation of the typhoid maximum there. It must be remembered, however, that we have to account for a similar retardation at Prague, Vienna, and other places; and it will be observed when we come to deal with Prague, that in this city other diseases besides typhoid exhibit a peculiar seasonal distribution. In Munich, Berlin, Breslau, and other parts of Germany, it has been observed that the number of cases of typhoid fever falls with the rise of the subsoil water (as measured by the depth of water in the surface wells), and rises with its fall, the amount of typhoid sickness being in relation to the range of fluctuation of the water. We may just point out that this rule is by no means universal. The Terling epidemy, to which we have referred under England, broke out when the water in the wells was high. Foder says that at Buda-Pesth the rise in the enteric fever mortality accompanies the rising ground-water, and that the two fall together (Parkes).

Inquiring into the relation of temperature and rainfall to typhoid fever prevalence in Berlin from 1871 to 1878, Hirsch concludes that, "as regards Berlin, there is no definite relation whatsoever to be made out between the height of the death-rate from typhoid and the states of the weather." If we compare the mean temperature of the year with the proportion of typhoid deaths, these are as often above the average in years when the mean temperature is below as in those years when the temperature is above the average. Taking, however, Hirsch's figures simply as they stand, it would appear that the temperature of summer, or of the third quarter, does, to some extent, determine the greater or lesser frequency of typhoid fever in the autumn quarter, and in the second half of the year generally. This will be seen from the following table :—

RELATION BETWEEN TYPHOID MORTALITY IN BERLIN AND TEMPERATURE (RÉAUMUR).

Years.	Average Annual number of Deaths above or below Average of Eight Years: above +, below −.	Temperature of Year above or below Average of Eight Years: above +, below −.	Deaths in Second Half of Year above or below Average of Eight Years: above +, below −.	Temperature of Third Quarter above or below Average of Eight Years: above +, below −.	Deaths in Autumn (Sept. to Nov.) above or below Average of Eight Years: above +, below −.	Temperature in Summer (June to Aug.) above or below Average of Eight Years: above +, below −.
1871	−	−	+	−	−	−
1872	+	+	+	+	+	+
1873	+	+	−	−	−	−
1874	−	+	−	+	−	−
1875	+	−	+	+	+	+
1876	−	−	−	−	−	+
1877	−	+	−	−	−	+
1878	−	+	−	−	−	−

It will be seen from this table that when the temperature of the third quarter is above or below the mean, the deaths in the second half of the year are correspondingly above or below the average in six out of the eight years; and the same relation is observed between the temperature of summer and the enteric deaths in autumn. So in Munich it was found that typhoid fever frequently appears after very hot and dry summers (Liebermeister).

Typhus caused an average death-rate in Prussia of 8 per million for the seven years 1881–87. In Saxony typhus is scarcely known at the present day; nor does it appear to be met with at all frequently in Bavaria or Wurtemberg. The eastern provinces of Prussia, both maritime and inland, are those most affected, and are also those most liable to suffer from typhus epidemics, which have generally invaded Germany from Poland and Galicia. Typhus has a special tendency to spread during periods of war and famine. Thus typhus was extensively prevalent in 1813–14 during the war, and in 1847–48 in a time of scarcity. Whether the outbreak in the Palatinate and in Silesia in 1853–56 was connected with want, I am unable to say; but bad crops and famine were the causes of the epidemy in East Prussia in 1867. East and West Prussia and Breslau again suffered in 1876–77.

A considerable number of cases were observed in East and West Prussia and Brunswick in 1883–84, in Mecklenburg-Schwerin in 1884, and in the Rhine Province in 1885,—which seems to show that the infection tends to make its way from the east to the west.

Relapsing Fever was first noticed in Upper Silesia and Königsberg in 1847–48 in isolated cases. The disease broke out in an

epidemic form in 1868, having been introduced from Poland and Russia, and it spread over a wide area. It made its appearance again in 1871–72, but not to any extent; and a third outbreak occurred in 1878–79. I find it mentioned in the returns as occurring in Posen, Silesia, East and West Prussia, and in Mecklenburg-Schwerin and Strelitz, in connection with typhus in 1884.

Epidemic Cerebro-spinal Meningitis was widely diffused over the eastern and western departments in 1863–70, attacking isolated localities, and not affecting extensive districts uniformly. It was frequently confined to barracks, workhouses, or prisons, while the towns in which these were situated escaped entirely or suffered only slightly.

Diphtheria and *Croup* together caused a mean death-rate in Prussia of 1750 per million living from 1881–87, a rate in excess of that of any country in Europe except Austria. In Saxony the death-rate for the period 1876–80 was 1056 per million, while in 1881–85 it had risen to 1763. The death-rate of Berlin, 1880–89, for diphtheria alone, was 1307 ; of Dresden, for the same period, for croup and diphtheria, 1575·3 ; and for Munich, 1089·7, per million. The deaths in Würzburg (1878–82) were 860 per million. We observe that a marked increase took place in Saxony during the last five-yearly period given above, and it is these irregularly recurring epidemic extensions that render it difficult to say in what part of the empire the disease is most fatal.

In Prussia the admissions from diphtheria per 1000 of all diseases averaged 21·0 for the years 1883–85 ; in Bavaria for the same period they were 12·2 ; in Wurtemberg, 9·9 ; in Baden, 10·8 ; and in Saxony, 36·3. Hirsch gives it as the result of his study of the distribution of diphtheria, that elevation and configuration of the ground have no influence on the occurrence of the disease. Even the influence of overcrowding, bad drainage, and general neglect of hygiene in favouring the prevalence of the disease has been called in question by many authorities. Diphtheria has been of late years particularly prevalent in the plains of North Germany, along the shores of the Baltic, in the eastern districts of Marienwerder and Bromberg, and in Brandenburg, Hanover, Prussian Saxony, and the kingdom of Saxony, and is, upon the whole, notwithstanding epidemic exacerbations, less prevalent in the higher hilly regions of Prussia and in the southern States of the empire.[1] Diphtheria is, other things being equal, least fatal in the largest towns with a population of over 100,000 ; although some of these, such as Danzig and Königsberg, have suffered very severely, the former having had a

[1] Living in damp dwellings and in rooms on a level with the earth seems to exercise an evil influence in respect to the spread of diphtheria. Ziemssen's *Cyclop.* vol. i.

death-rate of 2050 and the latter of 1820 per million for the five years 1878–82. It is more fatal in the towns of 20,000 to 100,000 inhabitants, and most prevalent in the small towns with a population under 20,000. Thus in 1886–87 the deaths from croup and diphtheria formed 61·7 per 1000 of the total deaths in the 1199 towns having 20,000 inhabitants and under; while they amounted to 50·2 per 1000 only in the 69 towns having a population between 20,000 and 100,000. In Saxony the deaths per 10,000 living were 16·31 in the large towns and 21·79 in the country.

In Berlin, Dresden, and Munich, the distribution of the deaths from diphtheria and croup occurring between 1881–88, by quarter, were :—

	First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.
Berlin, .	27·03	21·40	19·77	31·80
Dresden, .	28·10	20·14	17·86	33·89
Munich, .	29·17	23·17	16·97	30·69

These diseases are thus most fatal during the cold season, particularly in the fourth quarter.

Diarrhœal diseases are classified in the Prussian official returns as *Ruhr* (dysentery), *Einheimischer Brechdurchfall* (cholera nostras), and *diarrhöe der Kinder* (infantile diarrhœa).

In Prussia an average of 419 deaths per million living was ascribed to infantile diarrhœa, of 473 to cholera nostras, and of 104 to dysentery, in the seven years ending 1887—or a total average for the three diseases of 996 per million living. According to the figures given in the Registrar-General's Quarterly Returns, the death-rate from the whole class of diarrhœal diseases per 1000 living, for the ten years 1880–89, was, for the Hamburg State, 2·57; for Berlin, 4·0; for Breslau, 3·73; for Dresden, 1881–89, 2·34; and for Munich, 5·37. The exceptionally high mortality from this class of diseases at Munich points to local sanitary defects in that city; but the diarrhœal death-rate is inordinately high in all the large German towns.

The prevalence of the diarrhœa of children and cholera nostras is largely dependent on the density of population, or, to speak more precisely, on overcrowding, with its accompaniments and results, as will be seen from the following table :—

	Diarrhœa of Children (1886–87). Average Deaths per 1000 Deaths from all Causes.	Cholera Nostras (1886–87). Average Deaths per 1000 Deaths from all Causes.
Berlin, . . .	68·3	93·6
Breslau, . . .	91·55	32·35
Cologne, . . .	63·25	57·8
Sixty-nine towns with 20,000 to 100,000 inhabitants, . .	37·05	50·8
One thousand one hundred and ninety-nine towns with 20,000 inhabitants and under,	15·6	22·8

Diarrhœa of children and cholera nostras and cholera infantum are most fatal during the third quarter. Both of them are, no doubt, more prevalent in warm seasons. This relation has been proved as respects the latter, as will be seen by the following table from Hirsch, showing the deaths from cholera infantum and the summer temperature at Berlin for the years 1877–82 :—

Year.	Mean Summer Temperature (Réaumur).	Deaths for the Year.
1882, ...	16·1	2510
1881, ...	16·2	2684
1877, ...	16·3	2947
1879, ...	16·7	3124
1878, ...	16·8	2886
1880, ...	17·5	3477

Diarrhœa, cholera, and dysentery were all very much more fatal in 1886 than in 1887. The death-rates per 10,000 in these two years were :—

Dysentery.		Cholera.		Infantile Diarrhœa.	
1886.	1887.	1886.	1887.	1886.	1887.
0·59	0·35	6·55	4·90	5·23	4·23

The explanation of the excess of mortality in 1886 was the high temperature in August and September of that year. In Berlin the temperature of August was 0·9, and that of September 3·2, above the normal; whereas in 1887 August had a mean temperature of 1·6, and September 0·9, below the normal.

Lombard states that, from 1835–38, the deaths in Berlin caused by diarrhœa and cholerine formed 18·6 per 1000 of the total deaths; in 1868–69 they amounted to 109 per 1000 of the deaths; in 1872 they constituted 134 per 1000, and in 1873 they had risen to 173 per 1000; and he inquires: "Où s'arrêtera cette augmentation?" It appears that only a slight improvement in this respect has taken place, as in 1886 the proportion was 178·4, and in 1887 it was 145·4. This remarkable increase in the fatality of diarrhœal diseases during the fifty years covered by these figures is, as Lombard remarks, a fact of the highest importance; but

it can scarcely be said to be "unique dans les annales de la statistique médicale," for it will be seen that a similar augmentation in the fatality of this class of maladies has been observed in England.

Dysentery, in 1882, furnished 3·47 per 1000 hospital admissions in Prussia; 0·27 in Bavaria; 0·28 in Saxony; 0·18 in Wurtemberg; and 0·12 in Baden. It thus appears to be more common on the plains than on the higher lands of the interior. Hirsch, however, notices that dysentery is rarely seen in the Dittmarschen, where ague is common. He also remarks that in the Wurtemberg epidemy of 1838 it was almost exclusively the highest districts that were attacked, which proves that the epidemic disease does not confine itself to localities where it is endemic. Dysentery is most prevalent in the Prussian districts of Bromberg, Oppeln, Gumbinnen, Danzig, and Lüneburg.

Asiatic Cholera.—Germany was visited by cholera in 1831, the disease having been introduced from Poland, Russia, and Galicia. From Poland it spread through the eastern governments of Prussia and Bohemia; from Russia it was carried to Danzig and the neighbouring departments on the Baltic, and from Galicia it invaded Austria and Moravia. In 1832–33 it entered the Rhine provinces from Holland. In 1837, Bavaria was attacked through the Tyrol. In this latter year cholera was again introduced into Silesia and East Prussia from Poland.

In the summer and autumn of 1848, Germany was anew invaded by cholera, which, advancing from Russia, attacked the Baltic and eastern provinces. The south and south-west districts suffered only slightly during this epidemy.

In 1852, 1853, 1855, and 1859, cholera was again introduced into the plains of the north and east of Germany from Russia. Bavaria was attacked in 1854, at a time when North Germany was almost entirely free from cholera.

In 1865, cholera was imported by a family from Odessa into Altenburg in Saxony, whence it spread to a few other places in the kingdom.

In 1866, cholera spread from Luxemburg into the Rhine provinces and Westphalia, and, surviving the winter, it caused a considerable mortality in this region in 1867. It made its appearance in May 1866 at several of the Baltic ports, and, extending inland over a great part of the country, it carried off no fewer than 114,683 victims. The spread of the disease was favoured on this occasion by the operations of war. Bavaria suffered from the pestilence in the same year. Cholera was once more introduced from Russia into the northern and eastern districts of Prussia in July 1871,

dying out in November, and reappearing in isolated cases in 1872. The following year (1873) witnessed a wide extension of this pestilence both in the north and in the south, it having been re-introduced at once from Russia and Austria. It proved specially fatal in the districts of Bromberg, Marienwerder, Königsberg, Magdeburg, and Danzig. It is thus evident that cholera, when it has appeared in Germany, has always been introduced from without; that it has raged with greatest severity in the plains of the north, Baden and Wurtemberg having almost escaped its ravages; and that the season of its greatest violence has been the summer and autumn.

Smallpox. — The death-rate from smallpox in Prussia, from 1881–87, averaged 43 per million; and in Saxony, from 1876–85, only 12 per million. In the other States the deaths range between the means of Prussia and Saxony. The influence of vaccination and re-vaccination in reducing the smallpox mortality in Germany has been clearly proved. Between 1781 and 1805 the death-rate from smallpox at Berlin averaged 3442 per million; while, during the forty years 1810–50, the ratio was 176 per million. At Berlin (1863–67) the greatest number of deaths occur in the three months April, May, and June, the maximum falling on May. The months of August and September are those when the deaths in that city are least numerous.

Scarlet Fever caused an average death-rate of 509 deaths per million in the principal towns of Germany from 1881–84; in Prussia (1881–87) the ratio was 518 per million, and in Saxony (1876–85) it was 503. At Berlin the deaths from scarlet fever (1880–89) numbered 392 per million; at Dresden, for the same period, 324 per million; and at Munich, 357·4. The English death-rate from scarlet fever (1881–84) was 485 per million.[1]

Measles appears in epidemies at irregular intervals. The death-rate in Prussia, for the period 1881–87, was 451; and in Saxony (1876–85), 249 per million. We cannot say with any confidence whether, or to what extent, humidity of the soil, the physical configuration of the country, the geological formation of the crust, or even sanitary conditions, affect the prevalence of measles. Scarlet fever and measles break out after a certain number of susceptible persons of tender years have accumulated in a locality; but it would be rash to conclude that the increase in the number of the susceptibles is a full explanation of the outbreaks of epidemies, and that

[1] Flügge makes the interesting observation that "Münster has been free from scarlatina for fifty years, Tuttlingen for thirty-five years, and Ulm for seventeen years." This he seems to ascribe to the result of accident, which appears to be a very doubtful explanation.—*Micro-Organisms*, Syden. Soc. Translation, p. 764.

increase in the amount and virulence of the poison as determined by temperature, locality, or other causes, counts for nothing in the epidemiology of these affections. The seasonal prevalence of measles in Berlin will be given under England.

Erysipelas, judging from the three years 1883–85, is rather prevalent in Wurtemberg, Hessen, the Rhine provinces, Baden, Westphalia, and Bavaria, but it is much less frequent in the northern plains.

Influenza has been frequently epidemic in Germany during this century. Thus, omitting slight visitations, it was epidemic from October 1800 to June 1801; in January and February 1803; and in November 1805. It was again epidemic from April to July 1831,[1] also during the same months of 1833, and in December 1836; from January to March 1837; from January to April 1841; in March 1843; in January 1844; and in November, December, and January 1847–48. Then it appeared in 1851, and again in 1855 from January to March, and in 1857 in December; in the winter of 1874, in the later months of 1889, and in the beginning of 1890. In most instances influenza has reached Germany directly or indirectly from Russia, and has passed westwards to France, the Netherlands, Britain, and, as in 1890, has then crossed the Atlantic to America. Its mode of spread is as yet imperfectly known, but there is little doubt that it may be introduced into a place where it has not been known by persons arriving from an infected locality. The frequency with which it made its first appearance in the post-offices during the recent epidemy, makes it probable that the infection can be transmitted by letters. It tends to recur in the year following its first appearance.

Whooping-Cough is one of the most dangerous diseases of children in Germany, as elsewhere. The death-rate from this disease in Prussia, from 1881–87, was 519; and in Saxony, from 1876–85, it was 309 per million. At Berlin, for the ten years 1880–89, the deaths were 319·4; at Munich, 298·3 per million; and at Würzburg (1878–82), 290 per million living. In England, the ratio for 1881–84 was 452 per million.

In the large towns of Prussia, with a population between 20,000 and 100,000, the deaths in 1886 numbered 11·8 per 1000 deaths; and in the towns with 20,000 inhabitants and under, the ratio was 16·5. In the town districts the proportion was 14·1, and in the country districts 24·3, per 1000. This relation is not met with

[1] The epidemy of 1831 appears to have originated in China in 1830, and to have spread in two directions—through the Eastern Archipelago to Singapore and India, and through Russia to Germany, England, and other countries in Europe, reaching North America in January 1832.

constantly, for in Saxony whooping-cough is more fatal in the town than in the country.

Phthisis is a very widely-diffused malady in Germany, where it causes a higher mortality than in most countries of Europe. In Prussia (1881–87) the death-rate from tuberculosis was 3082, and in Saxony, for the ten years ending 1885, the deaths from consumption averaged 2477 per million. Judging from the admissions into the public hospitals for the three years 1883–85, phthisis and tuberculosis were somewhat less prevalent in Bavaria and Baden than in Prussia, and considerably less so in Wurtemberg. This view of the distribution of phthisis in Germany is supported by the following figures, taken from Hirsch, showing the incidence of the disease on the different regions of Germany. It must be remarked that the returns for Bavaria include not only pulmonary consumption, but other tubercular diseases:—

		Deaths from Phthisis per 1000 Inhabitants.
Baltic Departments,	1875–79,	1·61 to 3·22
Warthe and Oder,	,,	2·20 to 3·07
Prussian Saxony, The Mark, etc.,	,,	2·29 to 2·79
North Sea,	,,	3·02 to 5·14
Lower Rhine,	,,	3·55 to 5·29
Upper Rhine,	,,	3·17 to 3·98
Saxony,	1873–80,	0·90 to 2·81
Baden,	1874–81,	2·24 to 3·87
Hesse,	1877–81,	2·42 to 2·83
Bavaria,	1867–75,	3·14 [1]

Other things being equal, phthisis is more fatal in the large than in the small towns. In 1886–87 the ratio of deaths from tuberculosis to the deaths from all causes, in the towns with a population of between 20,000 and 100,000, was 141·8; while in the smaller towns, with a population of 20,000 and under, the deaths, to 1000 deaths from all causes, were only 124·9. Dr. Schlockow of Breslau gives, for 1876–79, the urban mortality from phthisis at 3710, and the rural at 2840, per million. As regards sex, he says that the mortality is in the ratio of 3470 males and 2810 females per million.

The disease does not appear to be influenced by latitude. It is true, as Hirsch points out, that the disease is less frequent in the territory of the Vistula, Oder, and Elbe, than in the territory of the Weser and Rhine; but it cannot be said that the plains of the north suffer less than the southern districts in the same meridian.

Schlockow has shown that tuberculosis is much more fatal in the western than in the eastern provinces, the high mortality in the Lower Rhine towns being specially remarkable. This has been

[1] For phthisis, general tuberculosis, and wasting, in persons over 15 years.

explained by the extent to which hurtful industries are here carried on in badly-ventilated rooms. Yet this explanation is not altogether satisfactory, inasmuch as in the smaller rural districts, where one would suppose that overcrowding and unhealthy industries were less common, the mortality from phthisis is very high. Whatever may be the explanation, the distribution-area of phthisis in Germany is in a marked degree determined by longitude. The following figures from Schlockow are quite conclusive upon this point. They give the mortality per 100,000 living:—

Eastern Provinces.		Western Provinces.	
Marienwerder, ...	161	Schleswig, ...	322
Königsberg, . . .	174	Triers (Treves), . . .	355
Danzig, ...	174	Wiesbaden, . . .	398
Posen, ...	230	Hanover, ...	399
Stettin, ...	239	Aachen (Aix-la-Chapelle), .	402
Potsdam, ...	253	Coblenz, ...	433
Frankfort, . . .	254	Minden, ...	471
Erfurt, ...	270	Köln (Cologne), . .	511
Magdeburg, . . .	279	Münster, ...	517
Breslau, ...	307	Düsseldorf, . . .	529

In the smaller eastern rural districts the mortality was often as low as 102, 112, etc., while in some of the western *Kreise* it was as high as 600 per 100,000.

Phthisis is thus less frequent in those districts where typhus and gastric fevers, ague and diphtheria, are most fatal; but it would not be difficult to point out localities, such as Oldenburg, where typhoid fever, ague, and tuberculosis all flourish side by side. On the contrary, the districts in which consumption is most prevalent are also those where pneumonia is most fatal.

The months of winter and spring are those charged with the greatest mortality.

Phthisis diminishes in frequency, other things being equal, according as we rise above the sea-level, as will be seen by Merbach's table for Saxony, and Corval's table for Baden:—

Saxony.		Baden.	
Altitudes in Metres.	Deaths per 1000. From 14 to 60.	Altitudes in Feet.	Deaths per 1000.
100–200, . . .	4·9	330–1000, . . .	3·36
200–300, . . .	3·3	1000–1500, . . .	2·75
300–400, . . .	3·2	1500–2000, . . .	2·60
400–500, . . .	3·5	2000–2500, . . .	2·75
550–650, . . .	3·3	2500–3000, . . .	2·33
		Above 3000, . . .	2·17

Pneumonia and *Pleurisy* together occasion a mortality of 1422 per million in Prussia, the rate varying slightly in different years; thus:—

	1881.	1882.	1883.	1884.	1885.	1886.	1887.
Deaths per Million, .	1426	1348	1449	1336	1417	1496	1481

The following are the death-rates from pneumonia of several towns of Germany, as given by Hirsch, arranged from north to south:—

Town.	No. of Years observed.	Death-rate per 1000.
Hamburg,	9	2·1
Bremen,	7	1·2
Berlin,	13	1·5
Halle,	10	2·3
Frankfort-on-Maine,	21	1·4
Wurzburg,	4	1·5
Stuttgart,	10	1·9

If, instead of the death-rate, we take the admission-rate into public hospitals for acute inflammation of the lungs and pleura, we have the following results as respects the principal States of the empire:—

Admissions for Pneumonia and Pleurisy per 1000 of all Cases.

	1882.	1883–85.		1882.	1883–85.
German Empire,	...	38·4	Wurtemberg,	30·8	30·8
Prussia,	43·7	...	Baden,	25·8	29·5
Bavaria,	39·9	39·7	Hessen,	31·1	35·9
Saxony,	24·9	31·3			

It appears from these figures that pneumonia and pleurisy are most prevalent in Bavaria and Prussia, and least frequent in Baden and Saxony; while, although somewhat more common in Wurtemberg and Hesse than in the last-mentioned States, pneumonia and pleurisy are still in these countries under the average of Germany as a whole.

In Prussia the mean death-rate from pneumonia and pleurisy for the whole country, in 1886, was 1·49. In the same year the ratio was 2·64 per 1000 in Münster; 2·02 in Osnabruck; 2·00 in Cassel; 1·97 in Minden; 1·88 in Düsseldorf; and 1·87 in Hildesheim. It will be observed that all these districts are in the west, and correspond, at least in a general way, with the area of excessive phthisis prevalence. In the eastern departments the deaths from pneumonia were under the mean of the whole country. Thus the death-rate in Bromberg was 0·82; in Posen, 0·96; in Liegnitz, 1·06; and in Breslau, 1·17. This distribution is not peculiar to the year for which we have given the figures, but appears to be the normal distribution of pneumonia in Prussia.

Pneumonia is more fatal in the large than in the small towns; and it may be safely said that density of population, and the nature of the industries carried on in different regions, are more potent factors in determining the distribution of pneumonia than climate. The months of March, April, and May are those in which pneumonia is most fatal.

Lombard is of opinion that altitude plays an important part in respect to the prevalence of pneumonia. According to him, the mortality from this disease increases with altitude. This may be

the case; but the data is not sufficient, as respects Germany, to establish this relation with certainty.

Bronchitis is much less fatal in Germany than in England. It is most fatal in Potsdam, Arnsberg, Schleswig, Stralsund, Magdeburg, and Düsseldorf; and is least prevalent in Posen, Bromberg, Gumbinnen, and Münster. Bronchitis gives rise to a greater mortality in the larger towns than in the country generally.

Heart Disease and *Acute Articular Rheumatism* and *Gout* vary greatly in frequency in different parts of the empire, as will be seen from the proportion of hospital admissions from these affections per 1000. I give the average for the three years 1883–85:—

State.	Heart Disease.	Acute Articular Rheumatism and Gout.
Prussia,	10·8	8·8
Bavaria,	20·3	30·2
Saxony,	12·2	29·6
Wurtemberg,	13·9	23·4
Baden,	16·4	23·9
Hessen,	16·3	24·4
Alsace-Lorraine,	24·9	32·1

The excessive prevalence of acute rheumatism and of heart disease in Bavaria and Alsace-Lorraine must find its explanation in the habits of the population of these countries as regards diet. Excess in beer-drinking is possibly a cause of increased rheumatic affection and of heart disease in some parts of the empire. Acute articular rheumatism gives rise to 54 deaths per million, and heart disease to 231 per million in Prussia.

Cancer is one of the fatal diseases of Germany; and although less common in the north of Germany than in England or Sweden, it is yearly increasing in frequency, as will be seen from the following figures, which give the annual mortality per million from 1881 to 1887 in Prussia:—

	1881.	1882.	1883.	1884.	1885.	1886.	1887.
Deaths from Cancer per Million,	312	318	335	349	353	385	383

The average death-rate in Prussia for this period was 348, and in Saxony (1876–85) it was 697, per million. In the large towns of Prussia the disease is much more common than in the smaller towns. Cancer is excessively fatal in Schleswig, Stralsund, and Lüneburg; least so in the eastern districts of Marienwerder, Bromberg, Posen, and Oppeln.

Goitre is endemic in some parts of Wurtemberg, especially in the districts of Jaxt, Neckar, and the Black Forest, where, according to Hirsch, the cretins number 3·8 per 1000. The disease is also met with in some parts of Upper Bavaria, Baden, Alsace-Lorraine, and other districts.

Anæmia is a common affection, especially in Bavaria, Baden, Saxony, and Alsace-Lorraine; it is less general in Prussia, Hessen, and the Thuringian States.

Scorbutus is seldom met with save in the seaports, such as Hamburg and Bremen, and also to some extent in Bavaria.

Scrofula and *Rickets* gave rise in Prussia to a mean death-rate of 0·94 per 10,000 living in the period 1881–87, and to 0·37 per cent. of the total mortality. As scrofula and rickets are combined under the same heading, the returns do not permit us to compare the frequency of scrofulous diseases in Germany and in England, where rickets is returned separately, and scrofula is combined with other tubercular diseases. Still we may infer from these figures that scrofulous diseases are widely diffused in Germany. Scrofula is of specially frequent occurrence in Schleswig and Lüneburg, and to a smaller, but still to a considerable, extent in Stettin and Stralsund. In the east I find only one district, viz. Breslau, in which the death-rate from scrofula is above the mean of the whole country. In Münster in the west, and Marienwerder and Bromberg in the east, scrofula is less common. Hirsch states that besides the large towns, such as Munich, Stuttgart, Leipzig, Berlin, Stettin, Hamburg, Danzig, and Breslau, there are many other foci of it of greater or less extent, such as the Dittmarschen, the Hartz country, the Saxon Erz Mountains, Upper Silesia, Westphalia, Thuringia, etc. He believes that altitude and the wetness or dryness of the soil are of much less significance in relation to the prevalence of scrofula than dietetic and hygienic errors, especially the want of out-door exercise in children.

Diabetes appears to be neither more nor less common in Germany than in Europe generally. The average deaths in five localities, given by Hirsch, formed one per 1000 of the total mortality.

Syphilis, judging by the statistical returns of the disease among the soldiers, is less prevalent in Prussia than in any European country. But this is a fallacious test, inasmuch as the prevalence of the disease in the army depends to a large extent upon the proportion of celibates in the different armies. Where the soldiers are mostly married men the cases of syphilis will be correspondingly rare, even if the disease is prevalent in the country or locality in which the troops may be stationed. The average number of admissions into the public hospitals in Germany for venereal diseases, 1883–85, was 57·2 per 1000. In Hamburg the proportion was 110·8; in East Prussia, 107·1; in Berlin, 98·0; in West Prussia, 87·2; in Bavaria, 36·5; in Wurtemberg, 34·5, per 1000 of cases treated.

CHAPTER VIII.

AUSTRO-HUNGARY.

GEOGRAPHY.—The Austro-Hungarian Empire occupies the south-east of Central Europe, lying between 42° and 51° N. lat., and between 10° and 27° E. long.

Austria proper is divided into fourteen administrative departments, with an area of 115,903 square miles, and an estimated population in 1888 of 23,484,995 inhabitants. Hungary, including Transylvania, with Croatia, Slavonia, and the town of Fiume, has an area of 125,039 square miles, and a population in 1888 of 16,979,813 inhabitants. The total area of the empire is thus 240,942 square miles, with a population of 40,464,808 inhabitants.

Austro-Hungary is traversed by three great mountain chains—the Alps, the Carpathians, and the Sudetes. The Rhætian Alps, intersecting the Tyrol on the west, are continued, under the name of the Noric Alps, through Carinthia and Styria, terminating in the Leithan mountains south of Vienna. On the eastern side of the Danube the same system is continued from near Presburg as a semi-circular range, which, although bearing different names in its course, forms in its entirety the Carpathian range, dividing Hungary from Moravia on the north-west, from Galicia and Bukowina on the north and north-east, and then, running to the south and west, separates Transylvania from Moldavia and Wallachia. The Sudetes divide Silesia from Bohemia and Moravia, and, under the names of Riesen Gebirge, Erz Gebirge, and Böhmerwald, encircle Bohemia.

The plains are the Greater Hungarian Plain in the east, traversed by the Danube, the Theiss, the Maros, and other streams of smaller size; and the Lesser Hungarian Plain on the west. In Galicia there are the deep plains traversed by the Vistula and Dniester and their tributaries; and in Bohemia the elevated central plain traversed by the Moldau and its feeders. The greater part of the country—perhaps three-fourths—is mountainous or hilly.

The principal lakes are the Platten See (Balaton Tava), with an area of 400 square miles, and the Neusiedler See, 117 square miles in extent.

The Elbe and its tributaries, the Moldau and the Eger, rise in and traverse Bohemia. The Vistula, the Bug, as well as the Dniester and several of its tributaries, rise in Galicia. The Danube and its tributaries, the March, the Waag, the Gran, the Theiss, the Koros, the Maros, the Bega, and the Temes, which join it on the left, and the Inn, the Traun, the Leitha, the Raab, the Drave, and the Save, which enter it on the right, traverse Upper and Lower Austria, Moravia, Styria, Carniola (*Krain*), Slavonia, Hungary, and Transylvania.

The soil of the Hungarian plains consists chiefly of humus and clay. Swamps abound along the course of the Theiss and other rivers. A morass, covering some eighty square miles, is connected with the Neusiedler See. In Galicia, marshes of considerable extent are found in the department of Cracow, and in the circles of Wadowice, Zolkiewo, and Zloczow (Hirsch). Humid, water-logged, and marshy tracts are also met with in some parts of Bohemia, near the banks of the streams.

CLIMATOLOGY.—The following tables give the temperature and rainfall of various regions in Austro-Hungary:—

TEMPERATURE OF VARIOUS LOCALITIES IN AUSTRO-HUNGARY.

Locality.	Altitude in Metres above Sea-level.	Jan.	April.	July.	Oct.	Year.
Prague, Bohemia, . .	202	-1·4	9·1	19·6	9·8	9·2
Brunn, Moravia, . .	225	-2·5	9·3	19·8	10·0	8·9
Lemberg, Galicia, . .	298	-4·1	7·7	19·5	9·3	8·1
Linz, Upper Austria, .	377	-2·7	9·0	19·1	8·8	8·5
Vienna, Lower Austria, .	197	-1·7	9·9	20·5	10·0	9·7
Klagenfurt, Carinthia, .	440	-6·3	8·8	19·0	8·7	7·3
Laibach, Carniola, .	287	-2·6	9·8	19·7	10·8	9·4
Agram, Slavonia, . .	163	-0·5	11·9	22·3	12·3	11·3
Buda-Pesth, Hungary, .	153	-1·4	10·8	22·3	11·3	10·7
Szegedin, ,, .	89	-1·1	11·8	22·8	12·6	11·3
Panscova, ,, .	65	-0·8	12·2	23·0	13·3	11·7
Debreczin, ,, .	124	-2·4	10·7	22·4	11·4	10·5

The average annual rainfall is about 64 centimetres in Bohemia, Moravia, and Silesia; 73 cm. in Galicia and Bukowina; 83 cm. in Upper and Lower Austria; 115 cm. in Vorarlberg, the Tyrol, and Salzburg; 94 cm. in Styria, Croatia, and Slavonia; 107 cm. in Carinthia; 137 cm. in Gorz, Carniola, and Istria; 92 cm. in Dalmatia; 59 cm. in Hungary; and 77 cm. in Transylvania.

Monthly Distribution per cent. of the Rainfall in Austro-Hungary.

Month.	Alpine Austria,—Salzburg, and Styria.	Bohemia, Moravia, Silesia, and W. Galicia.	E. Galicia, Bukowina, and Transylvania.	Hungarian Plains.	S.-W. Hungary, Croatia, and Slavonia.	S.-W. Carinthia, Carniola.
Jan.	5	5	4	6	6	6
Feb.	5	6	5	5	5	5
Mar.	7	7	7	7	7	7
April,	7	7	7	7	8	7
May,	10	10	12	11	9	9
June,	12	13	15	12	11	9
July,	13	12	14	11	9	9
Aug.	13	12	11	10	9	9
Sept.	9	8	7	6	9	10
Oct.	6	6	6	8	10	11
Nov.	7	7	6	9	9	10
Dec.	6	7	6	8	8	8

Vital Statistics.—The marriage-rate in Austria for the ten years ending 1887 was 15·6; the birth-rate, 36·8; and the death-rate, 30·0, per 1000. In Hungary the marriage-rate for the ten years ending 1884 was 19·7; the birth-rate, 44·4; and the death-rate as high as 35·7, per 1000. The heaviest mortality falls on winter or spring throughout Austro-Hungary, except in Dalmatia, the Banat, and Temesvar, where it is estival or autumnal.

Pathology.—*Malaria.*—In Bohemia, malaria is chiefly confined to the banks of the Moldau and its tributaries, and to some of the marshy localities of the south and east. In Prague the disease is not endemic.

Malarious foci are met with in the marshy districts of Cracow, Wadowice, Zolkiewo, and Zloczow in Galicia. According to Duchek, intermittent fever is by no means rare in the neighbourhood of Lemberg. Hirsch states that the southern part of the country, rising in terraces towards the Carpathians, is little affected by malaria, and that a like exemption is enjoyed by the southern slopes of that range. The Duchy of Bukowina enjoys a certain immunity as regards malaria. Czernowicz, the capital, situated in the centre of a marshy region, suffers considerably in summer, as does also the environs of Smyatin and Zalcaspki, on the banks of the Dniester (Lombard).

In Silesia and Moravia, malaria is endemic in a few places along the course of the Oppa, the Oder, and the March.

The Tyrol, Styria, Carinthia, and Salzburg are, as a whole, healthy, malarious foci of limited extent being met with only in some of the marshy valleys. At Klagenfurt, the capital of Carinthia, situated on

the river Glan, two miles east of the Wörthsee, with its marshy surroundings, intermittent fever is rather common.

The upper course of the Danube is but little affected with endemic malaria; but below Vienna ague is rife on the banks of the Danube, and still more so in the basin of the March. In Vienna itself malarial sickness is by no means prevalent or severe. As we descend into the plains of Hungary, we come upon a region where malaria is widely endemic, and manifests itself in its more intense forms. In the basins of the Waag and the Gran to the north, and along the lower course of the Raab to the south of the Danube, and in the country lying to the east of the Raab, through the Bakonyer Wald and stretching south-east to Stuhlweissenburg, and to the districts between the Platten See on the west, the Danube on the east, and the Drave on the south, malaria occupies a leading place, not only in respect to frequency, but also in regard to its deteriorating effect on the constitution of the inhabitants.

The lower courses of the Drave and Save are also more or less malarious, but Croatia and the higher lands of Slavonia are comparatively healthy. Buda-Pesth is comparatively free from ague, as is the country along the left bank of the Danube from Buda-Pesth to Felegyhaza. The marshy region traversed by the Theiss and its tributaries, notably the Szamos, the Bodrog, the Koros, and the Maros, is in a high degree malarious; and the fever here often assumes a grave type after the inundations to which these rivers are subject. The inhabitants in many localities suffer from cachexia.

The Banat, in the south-east corner of Hungary, situated between the Maros and the Danube, is another district noted for its extreme unhealthiness. Paget in his work on Hungary and Transylvania says, "that from the flatness of a large portion of the surface, and from the number of the rivers by which it is watered, immense morasses are formed, which taint the air, and make it really what the French writers call it, 'le tombeau des étrangers.'" The soil is a rich loam. After the hottest day, the sun no sooner sets than a cool breeze arises, refreshing at first, but which becomes dangerous to those unprepared for it.

The province of Transylvania is a moderably-elevated plateau, surrounded by mountains on the north, east, and south. It is a country of hills and valleys, drained by tributaries of the Theiss. Here malarial diseases are much less generally met with, being only prevalent in a few humid valleys, along the banks of some of the

streams, and in the marshy district between the Maros and the Szamos.

The Istrian Peninsula is, upon the whole, much less malarious than Hungary. Trieste, formerly subject to fevers, is, according to my inquiries made on the spot, now almost exempt from this class of diseases. Ague is, however, met with, although in a comparatively mild form, at numerous spots along the coast, such as Citta Nuova, Parenzo, Rovigno, Pirano, and Capo d'Istria. Pola is perhaps the most unhealthy spot in the peninsula. It is situated near the south point of Istria. "The soil has for basis a compact calcareous formation of metallic hardness, presenting numerous crevices filled up by the clay, which forms also at the bottom of the valleys a subsoil covered over by a more or less thick layer of vegetable matter. In these valleys the rainfall accumulates, on account of the clayey bed, and hence arises permanent foci of marsh emanations."[1]

In Dalmatia, fever is met with at numerous points along the coast—at Zara, at the mouth and for some distance up the course of the Narenta, and at Ragusa. The high lands of the interior are healthy, as are also most of the islands lying along the coast.

As in Germany, so in Austro-Hungary, local epidemics of malaria are often observed to arise from excavations of the soil and from inundations.

In 1856–57, numerous cases of ague, complicated with the worst forms of malarial cachexia and dropsy, were admitted into the General Hospital, Vienna, occurring in labourers employed on the railroads in Hungary. As illustrating the baneful influence of inundations in developing and intensifying the malarial infection, we may quote two instances cited by Lombard. After the inundations of 1853, at Gross Wardein on the Koros, 18,000 persons were attacked with fever out of a population of 22,000. Such is the effect of inundations in a malarious country. Galicia, on the other hand, as we have said, is little subject to malaria; but, after the inundations of 1845 and 1846, fevers of a refractory character spread wherever sheets of stagnant water were left to form marshy pools.

We are indebted to Hirsch for statistics of the monthly incidence of malaria on four localities in Austro-Hungary, which we shall give along with the mean monthly temperature (centigrade) and rainfall of Vienna in the north and of Pola in the south.

[1] Rey, *Nouveau Dict. de méd. et chir.*, Paris 1872.

	Vienna.			Pola.			Klagenfurt.	Szent-Miklos.
	Average Mean Temperature.[1]	Average Rainfall mm.[1]	Monthly Percentage of Fever Admissions.[2]	Average Mean Temperature.[3]	Average Rainfall mm.[4]	Monthly Proportion of Fever Admissions.[5]	Monthly Percentage of Fever Admissions.[6]	Monthly Percentage of Fever Admissions.[7]
Jan.	-1·7	35	3·47	5·7	47·0	2·4	7·10	3·95
Feb.	0·1	36	3·13	7·0	41·2	1·9	5·08	2·71
Mar.	4·3	43	5·71	8·0	82·3	2·0	5·60	3·44
April,	9·9	42	10·50	12·6	77·4	2·4	7·20	9·08
May,	15·1	64	15·01	16·2	62·4	2·8	11·95	12·06
June,	18·8	66	11·70	22·1	81·3	2·9	10·08	8·65
July,	20·5	65	8·90	23·6	37·8	8·7	9·72	9·56
Aug.	19·7	72	9·44	24·7	73·0	14·2	9·00	16·26
Sept.	15·9	45	11·44	20·1	105·4	12·6	7·61	13·43
Oct.	10·0	44	9·49	14·1	117·0	11·3	9·90	9·47
Nov.	3·9	43	6·90	9·8	119·7	5·8	9·90	6·72
Dec.	-0·3	40	4·22	4·6	109·9	3·1	6·83	4·63

In Vienna there are two maxima, one in spring (April, May, and June) and the other in autumn (September). The spring rise is the principal one. Klagenfurt shows only one period of fever prevalence, which attains its acme in May and June. At Szent-Miklos there is a vernal exacerbation in April and May; but the principal rise takes place in August and September. In Pola, on the other hand, the vernal rise disappears, and more than half the cases occur in the three months, August, September, and October. The difficulty of explaining the seasonal distribution of malarious fevers by reference merely to temperature and rainfall will be apparent by examining this table. In Szent-Miklos the greatest rainfall is from May to July; in Pola, from September to December; in both localities fever attains its maximum in August and September. Perhaps it is still more difficult to account for the disappearance of the vernal rise in Pola. Were spring fevers relapses of autumn attacks, such relapses ought to be frequent in such a place as Pola. It may be, however, that among the civil resident population vernal fevers are more common than among the troops. We have no data bearing upon the question as to whether the intensity or prevalence of these fevers is in proportion to the warmth of the season. Hirsch quotes from Jilek a table giving the relation between the amount

[1] *Handbuch der Klimatologie*, von Julius Hann, Stuttgart.
[2] Hussa, ten years' admissions into General Hospital.
[3] Average temperature of three years, 1877, 1878, 1879.
[4] Average rainfall for the nine years, 1877–79 and 1882–87.
[5] Jilek, sickness on total force of troops, 1863–67.
[6] Hussa, twenty-five years' observations.
[7] Lach, for three years (1854–56).

of malarial sickness at Pola, and total annual rainfall, which we here reproduce:—

	1864.	1863.	1866.	1865.	1867.	1868.
Rainfall in Paris, inches,[1]	18·44	14·25	12·10	3·44	5·49	1·5
Cases of fever, per 100 men,	51·4	48·6	36·3	35·4	22·9	14·2

From this it will be seen that rainy years are the most feverish in Pola.

At Vienna the tertian type is the most common. Of 3126 cases, 1495 were of the tertian, 1293 of the quotidian, 243 of the quartan, and 95 irregular. Here we remark the large proportion of the quotidian type compared with that observed in Holstein. In the Banat and in Istria the quotidian type appears to be the most common. The pernicious and remittent forms are by no means rare in Hungary, Istria, and Dalmatia. In all these regions, where malaria is intense, it is remarked that strangers suffer much more than the native population.

Austro-Hungary has frequently suffered from general malarial epidemies, and here, as in the rest of Europe, the disease has been observed to extend to localities where it is not endemic.

Enteric Fever is widely prevalent as an endemic and epidemic disease in Austria. In the four years 1876–79 the deaths ascribed to typhoid fever (probably including typhus) were in the ratio of 765 per million living, and in 1881–84 the proportion is given by Raseri at 731 per million. In 1885–87 it stood at 683 per million. In the fifteen principal towns of Austria, for the period 1881–84, the typhoid death-rate was 449 per million. The disease is thus less prevalent in the largest towns than in the country generally. In Vienna the death-rate from typhoid and typhus fevers (1880–89) was 160·4 per million, while in Prague the ratio 1881–89) was 441 per million. As a point of comparison we may note that the typhoid death-rate of London in 1884 was 230 per million,—a proportion considerably in excess of Vienna, but little more than one half of that of Prague. In Austria the ratio of the deaths from enteric fever to 1000 deaths from all causes, from 1882–86, fluctuated between 22·4 and 25·7, with a mean of 23·7. Enteric fever appears to be of most frequent occurrence in Galicia, Bukowina, and Dalmatia, and to be least common in Lower Austria and Styria. Enteric fever is still more prevalent in Hungary than in Austria. Of 316,166 deaths occurring in Hungary (1878–80),[2] the causes of which were known, 11,497, or

[1] *Rapports annuel de l'hôpital général de Vienne, pour les années* 1855–62. Colin, *Fièvres Intermittentes*, p. 138.

[2] *Statistik der Bevölkerung Ungarns*, Buda-Pesth 1885.

3·64 per cent., were caused by typhus and typhoid fevers. Enteric fever is thus excessively fatal in Hungary, side by side with malarial fever,—a fact which shows that there is no antagonism between typhoid fever and malaria. Buda-Pesth suffers somewhat severely, for the deaths from typhus and typhoid in that city in the ten years ending 1889 were in the ratio of 533·1 per million living.

The quarterly distribution of typhus and typhoid deaths is given in the following table. The proportions are certainly determined by the typhoid element:—

	First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.
Vienna (1881–88),	27·12	22·51	25·55	24·82
Prague (1882–88),	30·39	31·05	19·46	18·94

At Prague, as at Munich, the usual autumnal maximum disappears, and the second quarter is that during which the typhoid deaths are most numerous.

Typhus Fever is said by Hirsch to have been epidemic in Galicia and Austrian Silesia in 1846–47, in Bohemia in 1847–50, and in Vienna in 1853, 1855–56, 1858–59, 1862–63, 1870–71, and in 1875. In the official statistics of recent years to which I have had access, this disease is not distinguished from typhoid fever, so that its frequency at the present time cannot be determined. Hungary has been ravaged at different epochs, especially during war, by epidemies which some believe to have been typhus, but which more probably included various forms of fever, continued and malarial, and differing in different periods.

Relapsing Fever was epidemic in Galicia in 1847, in 1865–67, in 1875, and in 1877–78. In Prague it broke out in 1865–67. I have not met with any reference to it in recent years.

Diphtheria.—The earliest account of the epidemic prevalence of diphtheria in Austro-Hungary, at least during this century, dates, according to Hirsch, from 1870, when it was introduced from Roumania into Transylvania. It appeared in Bukowina in 1874, and only reached Vienna in 1875. Since then it has become one of the most fatal diseases in Austro-Hungary. In Austria the average percentage of deaths from diphtheria and croup to the total mortality, from 1882–86, was 4·73. In 1886 the disease was most fatal in Silesia, Galicia, and Bukowina. Raseri gives the death-rate per million from diphtheria and croup (1881–84) at 1036 in the fifteen principal towns, and at 1663 per million for the country as a whole. During the three years 1885–87 the ratio for the country as a whole was 1397 per million. To show how excessively fatal diphtheria and croup are in Austria, it may be

stated that the death-rate from these diseases in England in 1884 was only 360 per million. In Hungary (1878–80), diphtheria caused 5·15 per cent. of the total deaths, which is a proportion somewhat higher than that of Austria. Here are the quarterly percentages of deaths from diphtheria in Prague, Vienna, and Buda-Pesth :—

	First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.
Prague (1882–88),	23·3	17·8	19·2	39·7
Vienna (1863–83),[1]	31·3	23·5	15·7	29·5
Vienna (1881–88),	30·7	24·7	16·1	28·4
Buda-Pesth (1884–86),	20·3	21·7	24·6	33·3

It will be observed that the first and last quarters are most charged with diphtheria deaths. In Prague it is the second, in Buda-Pesth it is the first quarter, and in Vienna it is the third quarter that has the fewest deaths. It will be remarked from the two periods given for Vienna, that the same seasonal relation seems to be pretty constant for a given locality.

Diarrhœa (Darmkatarrh) caused 4·89 per cent. of the general mortality, and *Dysentery* (Ruhr) 1·03, in Austria in the year 1886. The mean death-rate from the former (1885–87) was 1370, and for the latter as high as 440 per million. The average percentage of deaths from these diseases to the total mortality from 1878–80 in Hungary (excluding Croatia and Slavonia) was 6·03 and 1·84 respectively. If we remember that dysentery and diarrhœa together caused 4·9 per cent. of the deaths in England, we may judge of the frequency of these diseases in Austro-Hungary. Dysentery appears to be most fatal in Galicia, Bukowina, and Dalmatia, and least so in Upper and Lower Austria and Salzburg—the provinces in which diarrhœa makes most victims.

The death-rate per million living from diarrhœal diseases as a class in Vienna (1881–88) was 1912·2,—a much smaller proportion than that of Berlin, but double that of London. In Prague the mortality from diarrhœal diseases (1882–88) was 1010·6 per million. In Buda-Pesth (1885–88) diarrhœal diseases gave rise to a death-rate of 3440 per million. In all these localities it is the third quarter in which diarrhœa is most fatal, and the excess in the third over the other quarters is in proportion to the prevalence of the disease.

Asiatic Cholera visited Austro-Hungary in 1831–32, in 1837, in 1849–50, in 1854 and 1855, in 1865–66, when it proved very fatal, and again in 1871–74. The mortality was at its height in

[1] Hirsch, *op. cit.* If it be the case that diphtheria only appeared in Vienna in 1870, the cases before that date must have been of the nature of croup, or at most, sporadic cases of diphtheria.

the year 1873, the deaths from cholera in that year being 107,007. In 1886 there were 354 cases of Asiatic cholera in Buda-Pesth.

Smallpox makes considerable ravages in Austro-Hungary. In Austria (1881–84) the deaths per million living were 705, and in 1885–87, 460 in the country as a whole, and in the former period 843 in the principal towns.[1] Galicia has always been noted as one of the principal haunts of smallpox. In the five years, 1882–86, smallpox caused 2·01 per cent. of the deaths in Austria, and in 1878–80 it gave rise to 2·62 per cent. of the deaths in Hungary.

Scarlet Fever and *Measles* caused 586 and 460 deaths respectively per million living in 1881–84. In 1885–87 the ratios were 573 and 583 in Austria,—proportions in excess of those in England and Wales during recent years.

The quarterly distribution of these two diseases in Prague and Vienna is as follows:—

	Measles.				Scarlet Fever.			
	First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.	First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.
Prague (1882–88), .	21·1	45·1	20·6	13·2	20·7	19·9	26·5	32·8
Vienna (1881–88), .	29·5	41·1	13·7	15·6	29·4	28·9	18·2	23·4

If we refer back to the seasonal distribution of diphtheria, it will be observed that that disease is at its minimum in Vienna in the third quarter and in Prague in the second quarter; the same seasonal peculiarities are here observed in respect to scarlet fever. Measles attains its maximum in the second quarter both in Vienna and Prague.

Influenza has never failed to visit Austro-Hungary when it has been epidemic in Germany; and what we have said respecting the periods of its prevalence in the latter country will apply generally to Austro-Hungary. During the late epidemy there occurred, between the 11th November 1889 and the end of January 1890, no fewer than 930,478 certified cases of influenza, and 2823 certified deaths.

Phthisis is more fatal in Austro-Hungary than in any other European country. The official reports give the phthisis death-rate in Austria from 1876–79 at 3910 per million; from 1881–84 phthisis (including tabes mesenterica and tubercular meningitis) caused a death-rate of 3839 per million; and from 1885–87 of 3890 per million living. In the fifteen principal towns the mortality for 1881–84 is given as 7220 per million. This excessive urban mortality is so far confirmed by the figures given by Hirsch,

[1] In Austria, where neither vaccination nor revaccination are compulsory, the mortality (1874–84) was twenty-seven times higher than in Germany, where both are compulsory. Proust at Acad. de Méd., Jan. 1891.

on the authority of Körösi, for Vienna, which give the average phthisis death-rate of that city from 1865–74 as 7·7 per 1000. In 1886 the highest death-rates were observed in Lower Austria and Carniola, and the lowest in Upper Austria, Salzburg, the Tyrol, and Galicia. Dalmatia, as a rule, stands favourably as regards its low phthisis death-rate. The percentage of the total deaths ascribed to phthisis in Austria for the five years 1882–86 was 13·26, and in Hungary (1878–80) it was 12·12 per cent.[1] In Buda-Pesth the mortality from phthisis (1872–75) reached 6900 per million (Hirsch). The death-rate from phthisis in Hungary, although excessive, is somewhat under that of Austria; but there is here at least no antagonism between malaria and phthisis.

Pneumonia, Pleurisy, and *Bronchitis* (in 1881–84) occasioned a death-rate of 2809 per million, and in 1885–87 of 3020, in Austria as a whole, and of 3795 per million in the principal towns (1881–84). From 1882 to 1886 inflammatory diseases of the respiratory organs occasioned on an average 10·24 per cent. of the total deaths; while in England, bronchitis, pneumonia, and pleurisy formed 15·2 per cent. of the deaths from all causes in 1884. In Hungary, inflammation of the lungs, by which pneumonia and pleurisy are probably understood, accounted for 7·46 of the total mortality. In Vienna, pneumonia caused 7·3 per cent. of the deaths from 1869 to 1873 (Lombard). In London, pneumonia and pleurisy caused only 5·2 per cent. of the deaths in 1884; from which we conclude, although with some reserve, that in Austro-Hungary bronchitis is considerably less fatal than in England, and that pneumonia is more so.

The monthly distribution of pneumonic cases in Vienna (1847–57) is thus given by Hirsch:—

Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
9·7	9·2	11·6	13·1	13·0	8·1	5·9	3·9	4·6	5·1	7·2	8·5

Whooping-Cough causes a considerable mortality both in Austria and Hungary. The death-rate from whooping-cough in Austria (1885–87) was 976 per million,—a ratio nearly double that of Prussia and England during the same period. The average percentage of the total deaths due to this disease in Austria (1882–86) was 3·61; and in Hungary (1878–80), 2·24. It is much more fatal in the towns than in the country.

Diseases of the Spleen are said to prevail in the Hungarian levels of the Danube and in the plains of the Moldau.

Dropsy.—The prevalence of malaria may account for the pro-

[1] *Statistik der Bevölkerung Ungarns*, Buda-Pesth 1885. See also Œsterreichisches *Statist. Handbuch*, Wien. 1889.

minent place taken by dropsy among the death-causes in Hungary, when it gives rise to 1·80 per cent. of the total mortality,—a proportion rather more than ten times as great as in England.

Cancerous diseases are far from rare in Austria. During the period 1885–87 the death-rate from cancer was 480 per million. These diseases are most common in the towns. I have no data as to their prevalence in Hungary.

Goitre and *Cretinism* have their headquarters in the Central Alpine regions of the Tyrol, Salzburg, Carinthia, and Styria,—there being in the last-mentioned province 1·5 cretins per 1000 of the population. The greatest proportion of the disease is found on gneiss and granite formations.[1] It is also met with in the valleys of the Bohemian mountains, in Galicia, on the northern slopes of the Carpathians. In Hungary, goitre is endemic in the valleys of the Carpathians, in the mountainous districts of the east, and also in the valleys of the Körös and Temes, in the Bakonier Wald, and in some other parts of the Hungarian plains. It is not endemic in Croatia, Dalmatia, Carniola, or in the valley of the Drave.

Leprosy is not endemic in any part of the empire.

Scrofula is frequent in the mountainous parts of Bohemia, in some parts of Upper Austria, Salzburg, Styria, and on the military frontier (Hirsch).

Syphilis does not appear to be more common in Austria than in the neighbouring States of Europe. It was endemic in a few localities in the circle of Bidschow (Bohemia) during the second quarter of this century.[2] Whether it has now been eradicated, I know not. According to Lombard, syphilis shows itself in Hungary with an intensity and gravity unknown elsewhere. He remarks that secondary and tertiary forms are very common in Croatia and Slavonia.

In the year 1800 a contagious disease, of a kind previously unknown, appeared in the government of Fiume. It broke out in the village of Scherlievo, which is situated about eight miles to the east of Fiume, and about three miles from the Adriatic coast. Cambieri, who was delegated by the Government to inquire into its nature, concluded that it was similar to the epidemic syphilis of 1493, and, like it, was propagated by ordinary social intercourse. It soon spread through Istria to Trieste in the north, to Dalmatia in the south, and inland to Carniola. This endemy lingered on in various localities in Croatia until the year 1855, perhaps later.

[1] Kratter, *Der alpine Cretinismus*, Graz 1884.

[2] Hirsch, *op. cit.*

CHAPTER IX.

ENGLAND AND WALES.

Geography.—England and Wales, which together form the southern and larger division of Great Britain, lie between lat. 49° 57′ and 55° 48′ N., having an area of 58,186 square miles, with a population estimated in 1887 at 28,247,151.

The greater part of England is level or undulating, the mountainous districts being chiefly confined to the north and west. In the north, along the Scottish border, are the Cheviots, which are continued southward for above 200 miles as the Pennine range through Northumberland and York to the centre of Derbyshire. Connected with this range is the Cumbrian system in Cumberland, Westmoreland, and the north of Lancashire.

The Cambrian or Welsh mountains consist of several ranges, occupying a large part of the Principality, and penetrating into the neighbouring border counties of England.

The south-western highlands of Devon and Cornwall, with which may be included the Cotswold Hills in Gloucestershire, the Mendips, the Quantock Hills, and the Blackdowns in Somerset, form a third system.

In addition, there have to be noticed the minor chalk ranges: the Wolds in York; the South Downs in Hampshire and Sussex; the North Downs in the north of Hampshire, Surrey, and Kent; and the Chiltern Hills, running through Oxford, Buckingham, and Hertford.

The principal plains are the Salisbury Plain in the south-west; the eastern plains, stretching along the coast from the Thames to the Wash; the plain of York, between the Wolds and the Pennines, which is continuous with the north-eastern coast plain; and, finally, the Central and Cheshire plain, which latter is continuous with the north-western coast plains. Considerable tracts of level land also skirt the northern shores of the Bristol Channel.

The greatest stretch of low flat land extends along the shores

of the Wash, running inland through Cambridge, Huntingdon, and Northampton. This district, known as the "Fens," covers about 700,000 acres, of which considerable areas are below the high-water level of the Wash, and are protected from overflow by embankments.

The rivers along the south coast are small. On the west we have the Severn, the basin of which has an area of 8580 square miles; the Mersey, draining an area of 1748 square miles; the Dee and the Eden, draining areas of 862 and 990 square miles respectively. As the highlands are situated along the western side of the island, the slope of the country is mainly from west to east, and as a result the chief rivers fall into the North Sea. Of the rivers on the east coast we may mention the Thames, with a basin of 6160 square miles; the Southern Ouse, the Nen, the Trent, and the Northern Ouse, terminating in the Humber, with a basin area of 9550 square miles. To the north of the Humber are the Tees, Tyne, and Tweed; the two former of which run through densely-populated regions.

The southern districts of England are chiefly agricultural; the central, south-western, and northern districts are the main seats of the mining and manufacturing industries. The great density of the population in these districts, and the nature of the industries carried on in them, tell more or less upon the health of the inhabitants, and determine the prevailing diseases.

CLIMATOLOGY.—The climate of England is mild, humid, and changeable. The difference between the temperature of the north, where it borders on Scotland, and that of the south coast, is about 3° to 3·5° F. The west has a higher temperature and a heavier rainfall than the east coast.

AVERAGE MEAN TEMPERATURE AND AVERAGE RAINFALL IN THE SOUTH, CENTRE, WEST, AND EAST OF ENGLAND.

	SOUTH.						CENTRE.					
	GUERNSEY.		BOURNEMOUTH.		PLYMOUTH.		OXFORD.		BIRMINGHAM.		LEEDS.	
	Mean Temp.	Rainfall.	Mean Temp.	Rainfall (Lymington).	Temp.	1881-88.	Mean Temp.	Rainfall (Thames).	Mean Temp. Oscott.	Rainfall.	Mean Temp.	Rainfall (1881-85).
January, . .	42·8	4·58	40·3	3·38	42·2	2·98	38·6	2·46	36·3	2·80	37·8	2 44
February, .	43·9	3·01	42·1	2·58	43·6	2·52	41·1	2·17	40·4	2·35	40·2	2·26
March, . .	44·5	2·61	43·3	1·88	44·8	2·81	42·3	1·55	40·9	2·13	41·6	1·79
April, . . .	48·9	2·53	48·7	1·96	50·0	2·10	48·5	1·85	45·3	2·21	47·8	2·10
May, . . .	52·4	2·15	52·6	1·65	53·9	1·93	52·8	1·79	49·5	2·52	52·6	1·34
June, . . .	56·9	1·78	58·4	1·98	59·3	2·07	59·2	2·08	57·2	2·72	58·8	2·39
July, . . .	60·8	2·40	61·8	2·31	62·5	2·82	62·3	2·34	68·1	3·01	62·0	2·79
August, . .	61·3	2·45	61·3	2·54	62·1	1·97	61·6	2·61	60·3	3·23	60·9	1·78
September, .	59·0	3·57	57·8	3·53	58·4	3·33	57·0	2·85	54·9	3·60	56·6	2·39
October, . .	54·4	4·90	51·9	3·20	52·5	3·69	50·3	2·56	48·5	3·40	49·3	2·91
November, .	47·6	4·57	44·1	2·87	45·6	4·29	42·4	2·09	40·7	2·36	41·9	2·32
December, .	44·5	4·82	41·3	2·98	42·8	3·59	39·7	2·64	37·0	2·76	39·2	1·88
Means and Totals.	51·4	39·37	50·3	30·86	51·5	34·10	49·7	26·99	47·6	33·09	49·1	26·39

	WEST.						EAST.					
	Barnstaple.		Liverpool.		Carlisle.		Greenwich.		Norwich.		North Shields.	
	Mean Temp. (1885–88).	Rain-fall.	Mean Temp.	Rainfall (1885–88).	Mean Temp.	Rain-fall.	Mean Temp. 60 years.	Rainfall 15 years.	Mean Temp.	Rain-fall.	Mean Temp.	Rain-fall.
January, . .	41·8	3·94	39·4	1·97	37·8	2·80	37·1	2·43	37·8	1·83	37·8	1·88
February, .	42·2	1·86	41·3	1·43	39·8	2·04	39·0	1·70	40·1	1·90	39·5	1·71
March, . .	41·6	2·62	42·3	1·72	41·1	1·66	41·5	1·39	41·5	1·70	40·2	1·51
April, . .	47·0	2·02	48·3	1·44	47·0	1·72	46·6	1·95	47·9	1·83	45·1	1·99
May, . . .	58·9	2·54	52·3	2·03	50·7	1·73	52·9	1·84	52·5	1·81	49·2	1·79
June, . . .	59·7	2·04	58·2	1·67	56·9	2·15	59·1	2·14	59·0	2·14	55·3	1·76
July, . . .	63·1	2·35	61·2	3·02	59·5	3·16	62·1	2·49	62·4	2·55	58·2	2·56
August, . .	61·0	2·00	60·9	2·07	58·7	3·52	61·3	2·52	61·8	2·43	57·6	2·74
September, .	57·2	3·89	57·0	3·08	54·8	3·16	56·8	2·49	57·6	2·90	54·0	2·63
October, . .	50·6	4·81	50·6	3·73	48·0	3·07	50·1	2·76	50·6	2·49	48·0	2·43
November, .	48·6	4·28	43·4	2·97	40·5	2·60	43·0	2·03	42·6	2·95	41·6	3·01
December, .	43·8	4·19	40·8	2·12	38·4	2·46	39·9	2·39	38·9	2·67	39·1	3·03
Means and Totals.	51·29	36·54	49·6	27·25	47·5	30·07	49·1	26·13	49·4	27·20	47·1	27·04

The mean daily range of Greenwich, on an average of ten years, is as follows :—

Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
8·8	10·3	14·7	17·6	20·0	20·2	20·2	19·8	17·3	13·7	10·4	9·1

The humidity attains its maximum from October to February.

Vital Statistics.—The mean *marriage-rate* for the ten years (1878-87) was 14·8 per 1000. The average *birth-rate* for the same period was 33·5 ; during the first five years it stood at 34·4, but has lately been decreasing, for during the last five it had fallen to 32·6. The average *death-rate* in England during the seven years (1881–87) was 19·2, while in the ten years preceding (1871–80) it was 21·4. The death-rate is thus diminishing, and is lower than that of any European country, except Ireland, Norway, Sweden, and Denmark. The lower death-rate in these countries being due to the relatively smaller proportion of the population aggregated in large towns and employed in unhealthy occupations. The average death-rate of the town districts (1881–87) was 20·21 ; that of the country districts, 17·54. In some of the agricultural counties, such as Surrey, Sussex, and Westmoreland, the average mortality for some years back has been under 17 per 1000.

The average death-rate per quarter in England and Wales is as follows :—

First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.
21·40	18·86	17·57	19·1

The first quarter is decidedly the most unhealthy, and the third quarter the healthiest. The higher mortality of the first quarter is chiefly owing to deaths from diseases of the respiratory organs, and from whooping-cough.

Let us now compare the quarterly death-rates of the town and country districts for the same series of years :—

	Town Districts.	Country Districts.	Difference.
Jan.–March, ...	22·17	20·17	2·00
April–June, ...	19·49	17·84	1·65
July–Sept., ...	18·97	15·17	3·80
Oct.–Dec., ...	20·26	17·06	3·20

The order in which the seasons stand as regards mortality is the same both in town and country; but the proportions in which the town and country stand to each other vary considerably in the different quarters, as will be seen from the third column. The excess of the death-rate of the town districts, as compared with that of the country, in the third quarter, is chiefly due to the fact that infantile diarrhœa, which is so common at this season, is specially prevalent and fatal in the large towns. The same disease also contributes to raise the town death-rate during the fourth quarter, as will be seen when we treat of diarrhœa; but the relatively high mortality of the town districts in the fourth quarter is mainly due to the fact that scarlet fever, diphtheria, erysipelas, and enteric fever attain their greatest prevalence during these three months; and as they are all, with the exception of diphtheria, more fatal in the large towns than in the rural districts, this helps to raise the town mortality proportionately higher than that of the country.

PATHOLOGY.—*Malarial Fever.*—In the time of Sydenham, and indeed much later, malarial fever was one of the most common, and by no means the least fatal, of the diseases met with in England. It is now comparatively seldom seen, and is still more rarely fatal. In 1841 and 1842 the mortality from ague was in the proportion of 8·2 to a million of persons living; in 1885 and 1886 the proportion had fallen to 3·2 per million. But the number of deaths from ague does not give an adequate idea of the amount of sickness it occasions. In Ceylon about one only in two hundred hospital cases proves fatal, and we may assume that only the worst cases are sent to hospital. In England, where the disease is incomparably milder, we cannot suppose that there are less than a thousand cases of illness for one case of death. Now, in 1887 there were four persons per million who died of ague, and the population numbered 28 millions; the total deaths from ague in that year were 112, which would give 112,000 cases of intermittent fever during that year, and this estimate is doubtless much under the mark. Simon justly remarks that "the amount of injury done to the health of the community by malarial disease is not to be reckoned by the number of deaths which malaria occasions. In a country where the disease is comparatively mild, death frequently results from

the secondary consequences—anæmia, dropsy, and debility—rather than from the disease itself." [1]

The deaths from ague in the several registration districts are too few to indicate, except in a very general way, the areas of its endemic prevalence. Although remittent fever is returned as malarial, and is, in fact, often so, yet there can be no doubt that under this heading many deaths caused by fevers of a non-malarious character are included. It is therefore the ague deaths alone that can with certainty be regarded as malarious. We shall give separate tables of the average death-rates from ague and remittent fever for the five years 1883–87:—

AVERAGE DEATH-RATE PER 1000 LIVING FROM AGUE IN THE REGISTRATION COUNTIES OF ENGLAND FOR THE FIVE YEARS 1883-87.

Rutlandshire,	0·000	Lincolnshire,	0·003
Westmoreland,	0·000	Nottinghamshire,	0·003
Oxfordshire,	0·001	Derbyshire,	0·003
Shropshire,	0·001	Lancashire,	0·003
Warwickshire,	0·001	West Riding,	0·003
Cheshire,	0·001	North Riding,	0·003
Monmouthshire,	0·001	North Wales,	0·003
South Wales,	0·001	Surrey (extra Met.),	0·004
London,	0·002	Somersetshire,	0·004
Middlesex (extra Met.),	0·002	Durham,	0·004
Northamptonshire,	0·002	Northumberland,	0·004
Suffolk,	0·002	Sussex,	0·005
Norfolk,	0·002	Hampshire,	0·005
Devonshire,	0·002	Essex,	0·005
Gloucestershire,	0·002	Wiltshire,	0·005
Herefordshire,	0·002	Cumberland,	0·005
Staffordshire,	0·002	Buckinghamshire,	0·006
Worcestershire,	0·002	Cambridgeshire,	0·006
Leicestershire,	0·002	Cornwall,	0·006
East Riding,	0·002	Huntingdonshire,	0·008
Berkshire,	0·003	Kent (extra Met.),	0·011
Hertfordshire,	0·003	Bedfordshire,	0·011
Dorsetshire,	0·003		

AVERAGE DEATH-RATE PER 1000 LIVING FROM REMITTENT FEVER IN THE REGISTRATION COUNTIES FOR THE FIVE YEARS 1883–87.

Oxfordshire,	None.	Leicestershire,	0·002
Huntingdonshire,	None.	North Riding,	0·002
Dorsetshire,	None.	Surrey (extra Met.),	0·003
Rutlandshire,	None.	Berkshire,	0·003
Middlesex (extra Met.),	0·001	Northamptonshire,	0·003
Norfolk,	0·001	Devonshire,	0·003
Wiltshire,	0·001	Cornwall,	0·003
Somersetshire,	0·001	Herefordshire,	0·003
Shropshire,	0·001	London,	0·004
Warwickshire,	0·001	Sussex,	0·004
Monmouthshire,	0·001	Suffolk,	0·004
Herefordshire,	0·002	Staffordshire,	0·004
Cambridgeshire,	0·002	Worcestershire,	0·004
Gloucestershire,	0·002	Nottinghamshire,	0·004

[1] *Privy Council Reports*, vol. i.

Average Death-rate from Remittent Fever—*continued.*

Cheshire,	0·005	Cumberland,	0·008
West Riding,	0·005	Hampshire,	0·009
Westmoreland,	0·005	Essex,	0·009
South Wales,	0·005	Derbyshire,	0·009
Buckinghamshire,	0·006	Durham,	0·010
Lincolnshire,	0·006	Northumberland,	0·010
East Riding (with York),	0·006	Kent (extra Met.),	0·013
North Wales,	0·006	Bedfordshire,	0·014
Lancashire,	0 007		

The position occupied by Bedfordshire and Kent in both tables points them out as specially malarious; and this is accounted for by marshy conditions prevalent in these counties. Huntingdon, with a death-rate of 8 per million from ague, as against an average for the whole of England of 3·2, must also be looked upon as an endemic seat of the disease in its more typical form; but it is rather remarkable that the remittent form was entirely absent from this county during these five years. It seems as if the great drainage works of 1851, by which the Whittlesea-Mere was converted into pasture and corn land, had completely banished the graver forms of malarial fever from Huntingdon. The small amount of malarious disease in Lincolnshire, with its low level plains, formerly noted for their insalubrity, is specially remarkable. That Cambridgeshire should occupy a high place in the list of aguish localities is easily understood; but one could scarcely have anticipated that Cornwall should have ranked along with Cambridge as respects the number of deaths from ague. Is this accounted for by the clayey nature of the soil—in many parts derived from disintegrated granite—and the heavy rainfall?

Dr. Peacock signalised North Aylesford in Kent, Huntingdon and Wisbeach in Cambridgeshire, as specially malarious.[1]

The upturning of the soil is not so frequently followed by local extensions of the disease in England as in many other countries; yet ague was observed to increase in a marked way, and hypertrophy of the spleen in children to become common, at the time when the Metropolitan Railway was being constructed.[2]

So far as we can judge, endemic malaria in England is related to marshy and moist clayey soils, or, more rarely, to the upturning of ground formerly malarious.

We have seen that malarious diseases have been steadily decreasing in England, and the question rises, To what is this due? There can be no doubt whatever that this result is chiefly to be ascribed to the extended reclamation, drainage, and cultivation that

[1] *Year Book*, New Sydenham Soc. 1859.
[2] *Med. Times and Gaz.*, July 29, 1876, p. 131.

have been going on during this and the preceding century. But it is not so certain that other conditions of which we know nothing have not also been working in the same direction, for it would appear that malarial fevers have become rare in recent years in localities where no drainage works have been carried out. Dr. Thorne describes the village of Terling in Essex as placed on a bed of London clay which here comes to the surface at the bottom of a small valley through which a stream flows. "This country for many miles around is generally flat; land springs are most plentiful; water is found in great abundance in ponds and in ditches by the road-side, and the atmosphere is unusually moist." "Ague," he adds, "was very prevalent throughout the neighbourhood until about the year 1840, but it is now seen on rare occasions." We read of no drainage, no improvements in cultivation, no alterations in the conditions of life, to account for the almost entire disappearance of a disease prevalent so recently as 1840, and the soil conditions existing when he wrote in 1866 appear to have been highly favourable to the persistence of the disease, which, however, has given place to typhoid fever. Other examples of the same kind could be quoted.

England, although at the present day it does not suffer from destructive epidemies of malaria, responds in a feeble way to epidemic influences. Thus we find that the deaths from ague increase in certain series of years, and some at least of these cycles correspond to wider epidemies affecting Europe generally. Thus intermittents were extremely prevalent in London between 1781 and 1785,—a period when it was extensively diffused over many parts of the Continent. Ague underwent a marked recrudescence in England in the years 1825–27, and I am not sure that this epidemy entirely disappeared before 1832. At the same time it was common all over Europe. Brown[1] says: "Since 1825 intermittent and remittent fevers have begun to show themselves with considerable frequency in districts on the east coast where they had formerly been little known, such as Sunderland, Shields, Newcastle, Hull, and in the northern parts of Lincolnshire." Macculloch[2] mentions that in 1826 the disease was common outside its usual haunts. In 1827 we are told that ague prevailed in every county of England, and in almost every street of London. The characteristic note of epidemic malaria is clearly noticed here, namely, its extension to districts where no marshy conditions prevail, and where it is, at other times, unknown. It is during such epidemies that the high lands, usually exempt, are often even more subject to the

[1] *Med. Essays on Fever*, etc., London 1828.
[2] Macculloch, *On Malaria*, London 1827.

disease than low and fenny localities. Thus, in 1780, Sir George Baker found malarial fevers to be prevalent in the elevated parts of Lincolnshire, while the inhabitants of the fens escaped. I have not ascertained whether 1825 and 1827 were unusual in any way as respects the weather, but it is stated that the year 1826 was very warm. The epidemy, however, had begun before then.[1]

The years 1857, 1858, 1859, and 1860 witnessed another, although less marked, period of malarial prevalence in England, which appears to have been part of what Hirsch calls "the great pandemic of 1855–60." During these years the deaths from remittent fever, as well as from ague, showed a marked increase; but, as we have already said, the deaths registered as caused by remittent fever are far from being all due to malaria.

The following are the deaths from ague and remittent fever, and the relation of the rainfall and temperature to the average, for the years 1853–62:—

	1853.	1854.	1855.	1856.	1857.	1858.	1859.	1860.	1861.	1862.
Ague, . . .	183	192	149	124	195	207	233	203	149	150
Remittent Fever, .	707	645	575	162	270	569	400	314	254	284
Departure of rainfall from average of thirt -nine years, .	+4·6	–5·7	–3·3	–2·2	–3·3	–6·6	+1·5	+7·6	–3·6	+1·8
Departure of mean temperature from average of thirty-nine years, . .	–1·6	–0·4	–2·2	–0·3	+1·7	–0·1	+1·4	–2·3	+0·1	+0·2

In 1852, the earliest period of which I have the record, the deaths from ague numbered 151; they increased up to 1854. A very decided decrease takes place in 1855, and a still more marked one in 1856. There was nothing, so far as we can see, in the meteorology of that year to account for this decrease. The temperature at Greenwich in 1856 was 0·3 under the average; while in the previous year, when the decrease in ague was much less marked, it was no less than 2·2 degrees under the average. There is surely some cause for the extraordinarily low mortality at once from ague and remittent fever in 1856. Are we to suppose that the very cold season of 1855 only attained its maximum effect in reducing the amount of ague in the succeeding year? Or are we to consider that ague and remittent fever were held in check by some anti-epidemic influence preceding and premonitory of the coming epidemy? This question can only be answered by studying the evolution of malarial epidemies elsewhere. In 1857, a year when the temperature was below and the rainfall above the average, the rise commences, and, as regards ague, attains its maximum in

[1] Good's *Study of Med.*, vol. i. p. 604, London 1834.

1859, when the number of deaths was nearly double that of 1856. By 1861 the deaths from ague had already fallen to about the normal. It is impossible to connect this recrudescence with any peculiarities of temperature or rainfall, — these meteorological elements varied during the different years.

During this epidemy the disease appears in many cases to have assumed graver forms than those which it usually exhibits.

Peacock says that there were "numerous cases of rapidly increasing anæmia, sometimes combined with purpura and jaundice"—symptoms often met with in epidemic malaria elsewhere.

Enteric Fever.—The death-rate per million living from enteric fever during the three successive quinquennial periods between 1871 and 1885 was:—

Five years 1871–75.	Five years 1876–80.	Five years 1881–85.
373·8	277·2	215·0

In 1887 the deaths from enteric fever formed nearly 1 per cent. (9·71 per 1000) of the total mortality. Considerable as the mortality is from typhoid in England, it is smaller than in many European States. Taking the three years 1885–87, the average mortality in sixteen of the great towns of France was in the ratio of 640 per million, or ·64 per 1000 persons living. Raseri gives for the period 1881–84 the enteric fever death-rate of Italy at 937, of Austria at 731, and of Spain at 563 per million. In Switzerland, during the same period, the deaths from typhoid fever were 230 per million,—a ratio very similar to that of England; while in the Netherlands the ratio was 140 per million in 1886–87.

The sickness-rate per 1000 of the population for the five years 1883–87, in 41 notification towns (Tatham), was 1·36. It is most fatal between the ages fifteen to twenty-five.

In the quarterly returns of the Registrar-General, typhoid, typhus, and ill-defined fevers are classed together; but as typhoid fever causes about ten deaths for one caused by typhus, it is reasonable to suppose that the greater or lesser prevalence of fever in each quarter will be a pretty fair measure of the greater or lesser prevalence of typhoid.

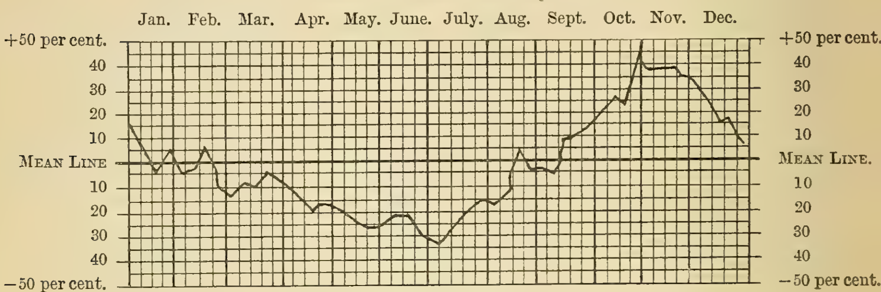
The fever deaths in England for the ten years 1878–87 were thus distributed as regards seasons:—

First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.
0·26	0·24	0·27	0·34

This shows that the fourth quarter (October, November, and December) is that in which typhoid fever is most fatal.

The monthly percentage of admissions of 2657 cases of typhoid fever, according to Murchison and Tweedie,[1] and the weekly mortality, according to the Registrar-General, are distributed as follows:[2]—

ENTERIC FEVER.—(12 years, 1869–80.)



The mean line represents an average weekly number of 17 deaths.

The months when the admissions are at their minimum are April and May. The number begins to rise in June, and attains its maximum in September and October. In London, the admissions are thus most frequent in those months when the rainfall is above the mean of the year, and when we may infer that the soil attains its maximum of humidity, but when the subsoil water in most localities is below the mean. As regards temperature, the rise in admissions commences in June, increases in July and August, when the temperature is at its highest, to attain its maximum in the months when the temperature is falling. The rise begins under one set of temperature conditions, and attains its maximum under another set of conditions; but the enteric curve follows closely, although at an interval of about two months, the temperature curve.

The curve of the monthly enteric death-rate is somewhat different, as will be seen from the diagram, representing the deaths for the period 1869–80.

Does the annual variation in the death-rate from typhoid fever bear any relation to the annual or quarterly temperature?

If we examine the annual death-rate from this disease, we shall find that it fluctuates considerably. Before 1869, typhoid fever was

[1] Murchison on Fever, Tweedie, *Lancet*, February 1860.
[2] *Annual Summary*, 1880.

classed along with typhus and simple or ill-defined fevers; but as typhoid is always by far the most fatal of the three, a great excess of fever in any individual year must be taken to indicate excessive prevalence of typhoid fever.

Now, on looking over the period 1863 to 1887, we observe certain years in which there was a marked excess of enteric fever deaths, and other years when their number was much under the average. We shall arrange these years in two tables, giving the difference of annual temperature above and below the mean, the difference from the mean of the temperature of the individual quarters, and the annual rainfall for the two series.

It must be remembered that the disease is becoming less prevalent yearly:—

YEARS IN WHICH ENTERIC FEVER WAS UNUSUALLY FATAL.

Year.	Temperature of Year above or below Average.	Temperature of First Quarter above or below Average.	Temperature of Second Quarter above or below Average.	Temperature of Third Quarter above or below Average.	Temperature of Fourth Quarter above or below Average.	Annual Rainfall above or below Average.
1865	+1·0	−3·4	+3·6	+2·1	+1·9	+4·6
1878	+0·3	+1·6	+2·0	+0·4	−2·5	+4·8
1880	+0·1	−0·1	−0·2	+1·0	−0·1	+5·4
1884	+1·4	+3·5	−0·1	+2·3	0·0	−6·3

YEARS IN WHICH ENTERIC FEVER WAS LESS THAN USUALLY FATAL.

Year.	Temperature of Year above or below Average.	Temperature of First Quarter above or below Average.	Temperature of Second Quarter above or below Average.	Temperature of Third Quarter above or below Average.	Temperature of Fourth Quarter above or below Average.	Annual Rainfall above or below Average.
1867	−0·7	−1·0	+0·9	−0·7	−1·6	+4·0
1877	+0·1	+2·4	−0·7	−1·9	+0·9	+2·5
1879	−3·1	−2·8	−3·1	−2·3	−4·2	+6·9
1881	−0·6	−2·6	+0·3	−0·4	+0·5	+0·8
1885	−0·7	+0·4	−0·2	−1·3	−1·3	−0·4

It appears from these figures that those years in which enteric fever in England is unusually fatal, are years in which the mean annual temperature is above the average, and in which the temperature of the third quarter is considerably above the average. The annual temperature is generally below the mean, and the temperature of the third quarter uniformly so (as far as the above table goes), in those years when enteric fever makes few victims. We observe here, apparently, something more than a simple coincidence. Although it is not to be assumed that the temperature of the third quarter necessarily regulates the prevalence of fever in the

succeeding quarter, it has a distinct influence in this direction. No rule is to be observed in respect to the influence of rainfall upon the amount of enteric fever.

Typhoid fever is more prevalent in the smaller town districts than in the twenty-eight great towns; and it is more prevalent in the great towns than in the country districts.[1]

Average Death-rates from Enteric Fever in Large Towns, Smaller Towns, and Country Districts (1885–88).

Large Towns.	Other Towns.	Country Districts.
0·21	0·24	0·18

The mortality from enteric fever in the different counties will be seen, from the following table, to vary greatly; the extremes being (1883–87) 0·05 per 1000 in Rutlandshire, and 0·34 per 1000 in South Wales:—

Average Death-rate per 1000 living in the Counties of England, from Enteric Fever, for the Five Years 1883–87, and for the Ten Years 1871–80.

	1883–87.	1871–80.		1883–87.	1871–80.
Rutlandshire,	0·05	0·31	Kent (extra Met.),	0·17	0·25
Herefordshire,	0·07	0·19	Middlesex (extra Met.),	0·17	0·24
Bedfordshire,	0·09	0·22	Northamptonshire,	0·17	0·33
Dorsetshire,	0·09	0·19	London,	0·18	0·24
Somersetshire,	0·10	0·26	Devonshire,	0·18	0·31
Surrey (extra Met.),	0·11	0·22	Leicestershire,	0·18	0·34
Suffolk,	0·11	0·21	Derbyshire,	0·18	0·34
North Wales,	0·11	0·24	Essex,	0·19	0·24
Berkshire,	0·12	0·22	Cheshire,	0·19	0·29
Oxfordshire,	0·12	0·26	Staffordshire,	0·20	0·36
Wiltshire,	0·12	0·24	Norfolk,	0·22	0·25
Gloucestershire,	0·12	0·26	Worcestershire,	0·23	0·26
Huntingdonshire,	0·13	0·26	West Riding,	0·23	0·45
Cumberland,	0·13	0·29	North Riding,	0·23	0·44
Sussex,	0·14	0·19	Hampshire,	0·24	0·30
Hertfordshire,	0·14	0·24	Nottinghamshire,	0·25	0·43
Warwickshire,	0·14	0·30	Lancashire,	0·25	0·39
Shropshire,	0·15	0·25	Monmouthshire,	0·25	0·33
Buckinghamshire,	0·16	0·24	East Riding,	0·26	0·40
Cambridgeshire,	0·16	0·24	Durham,	0·26	0·56
Cornwall,	0·16	0·34	Northumberland,	0·27	0·37
Lincolnshire,	0·16	0·27	South Wales,	0·34	0·45
Westmoreland,	0·16	0·30			

Let us now observe the geographical distribution of enteric fever in England, or rather the regions in which the mortality is in excess or in defect of the mean, which, for the period 1871–80, was 0·32 per 1000. An examination of the figures for the ten-yearly period will show that the enteric fever death-rate is in excess of the mean in the northern and north-central districts, in South Wales, in Monmouthshire, and in Cornwall; while it is below

[1] In the London Fever Hospital there have been far more admissions during the dry and hot summers 1865, 1866, 1868, 1870, than in the wet and cold summers of 1860 and 1872. Fagge, *Princip. and Pract. of Med.*, Lond. 1888.

the mean in the central and southern counties, in London, and in North Wales. To be more precise, the death-rate is in excess in Northumberland, Durham, York, Lancashire, Derby, Leicestershire, Nottingham, Stafford, Northampton, South Wales with Monmouth, and in Cornwall.

It is evident that this distribution is not determined by climate; for in the same county, districts in close proximity to each other suffer very unequally from enteric fever. Nor does its prevalence bear any definite relation to density of population; for, to take a single example, in the district of St. Giles in London, with only ·005 of an acre to each person, the death-rate from enteric fever was 0·19; while in that of Thorne, in the West Riding of York, with 4·28 acres to a person, it was 0·57 per 1000.

The disease is evidently more prevalent in the mining and manufacturing than in the agricultural counties, and, although truly ubiquitous, its excess appears to depend chiefly on those sanitary defects which are not peculiar to, but are more generally to be met with in, the smaller towns and villages of manufacturing and mining districts.

The death-rate of the two sexes for the whole of England for the period 1871–80 was exactly equal, which seems to prove that the liability to the disease is the same in both. If, then, we find that one sex suffers more than the other in any particular locality, we may assume that this is owing to that sex being more exposed to the cause of the disease. Now, it will be found that in the agricultural counties the female death-rate, as a rule, is in excess, while the reverse is the case in the mining and manufacturing counties. This seems to show that in the agricultural counties the cause of the fever is generally to be sought for in the homestead; while in the mining and manufacturing counties the cause is not so exclusively restricted to the home, but exists in connection with the mine, factory, and workshop.

Enteric fever, as we have seen, is most prevalent in the later months of summer and autumn; and, as a rule, it is most fatal in those autumns which follow upon warm summers. Why is this so? Let us at once accept the view which modern pathology regards as the only admissible one, that enteric fever is a specific disease, notwithstanding the variety of symptoms it exhibits, and the widely differing degrees of intensity it manifests. The disease is not, as a general rule, communicated directly from the patient to his attendant. When, therefore, we find the arrival in a village, previously free from the disease, of a typhoid patient being followed by an outbreak of fever,—and this often enough among those who have not been

in personal contact with the patient,—we are forced to conclude that something must have been given off from the sick person that has in some roundabout way entered the bodies of those who have subsequently contracted the disease.

Now, observations of the most varied and convincing character point to a contagium present in the excrements of the sick as the *something* causing the infection, and to drinking-water, milk, and other articles of food, as well as the breathing air of dwelling-houses contaminated by these discharges, or polluted by the specific infection derived from them, as the media by which the infection is carried from the sick to the healthy. Such is, no doubt, the usual way in which infection is conveyed.

But the pollution of drinking-water, food, or air by the infective matter directly derived from typhoid excreta is in every case of the nature of an accident, and we see no reason why such accidents should occur more frequently in certain months than in others. There must be something more, then, for the spread of typhoid fever than the accidental pollution of a well by percolation from a cesspool, or the diffusion of sewer gas into a dwelling by some defect in a trap or drain.

To account for the relative frequency of enteric fever in certain months, and for its greater prevalence after warm summers, we have to suppose that the infective matter is more generally diffused in these months and seasons; and this again presupposes the multiplication of the virus of the disease outside the human body; and, further, that this multiplication is favoured or hindered by certain conditions of soil, or of weather, or of both. In what way does this multiplication take place?

Let us assume, for the moment, and for the sake of illustration only, that the infective agent of typhoid fever is Eberth's bacillus. It was formerly pretty generally held that the spore derived from the typhoid bacillus is incapable of further development and growth in the soil,—that it is only after it has found its way anew into the body of a fitting host that it could accomplish the second stage of its development into a spore-producing bacillus. It was held, in fact, that the two stages of development take place alternately in the soil and the body.[1] Now, if this were so, it is evident that no multiplication of the infective matter outside the body is possible if the spores only are evacuated in the typhoid dejecta, for the multiplication of the bacillus by fission could, under ordinary circumstances, be only of limited duration. But it has been shown by Gaffky, as regards Eberth's bacillus, that these organisms are chiefly

[1] Liebermeister, *Ziemssen's Cyclopædia*, art. on Infectious Diseases.

evacuated along with the dejections "as resting spores." If these spores cannot multiply themselves until they once more enter the body, we have no adequate explanation of the greater prevalence of typhoid fever in the autumn months. Nor can we explain the numerous instances in which typhoid fever has been observed to break out in a locality where no cases had been observed for years, and where no fresh case has been known to have been introduced, unless we allow that the typhoid germ is capable of multiplication outside the body. The view that the spores must enter the body before undergoing further development, is necessarily associated with the doctrine of continuous transmission,—every case being assumed to be *directly* derived from a previous case, which is just the weakest point of the theory, inasmuch as, in perhaps a majority of instances, the previous case cannot be discovered.

A more probable explanation of the seasonal character of the disease is, that the typhoid spores evacuated in the stools can sprout into bacilli, and these again produce spores outside the body, in a suitable soil, and under certain conditions of temperature, such conditions being those found in warm autumns succeeding warm summers. Gaffky's observations have proved that, as regards Eberth's bacillus, such sprouting and multiplication actually take place, and he justly concludes that "even outside the animal economy they may increase enormously in numbers, and in the warmer part of the year may form spores afresh."[1]

If this view is correct, we should have the disease communicated in a certain number of instances by spores directly derived from a recent case; in other and more numerous instances, by spores originally derived from a typhoid patient, but which have been running through their development in the soil or other nutrient substrata, for an indefinite period. This variety in the mode of cultivation may yet be found to account for the great variety of type and intensity met with in different epidemies and in different countries.

If we accept the view that the enteric microbe is a facultative parasite, capable of living and growing during comparatively long periods outside the body, we shall find it easy to understand those outbreaks of the disease occurring in localities from which it has been absent for considerable periods. This view also accounts for the great diminution of fever which Buchanan has shown to follow the purification of soil and air by hygienic measures. It is in impure soils charged with organic matters that, under the influence of warm weather, we should expect to find the typhoid germ

[1] *Microparasites in Disease*, New Sydenham Soc. 1886, p. 252.

multiply itself with greatest rapidity. The greater frequency of typhoid fever in the small than in the large towns is probably owing, in part, to the fact of the soil in the former being more impure. The scattered dwellings so common in the smaller towns present special difficulties in the way of effecting the speedy and thorough removal of refuse. All these considerations favour the view that typhoid fever in England is both a miasmatic-contagious and also quasi-miasmatic disease.

Relapsing Fever was epidemic in 1851, but it has been less frequently noticed in England than in Scotland or Ireland. A small number of deaths ascribed to this fever are registered every year. In the five years ending 1887, they averaged only 21 per million of deaths from all causes; so that it can be said that in recent years the disease has been scarcely known in England.

Diphtheria has acquired a general extension in England since the year 1857. During the five years 1881–85, the average death-rate from this disease was 155·6 per million, or ·15 per 1000 persons living; while in the decennium ending 1880, the mortality was 121·3 per million.

Its quarterly prevalence during the ten years ending 1887 was as follows:—

First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.
0·14	0·11	0·12	0·17

According to the Registrar-General,[1] "there are two tolerably definite areas in which this disease apparently finds its most suitable home. The one has its base in the south-eastern counties, Sussex, Hampshire, Surrey, and Kent, and stretches upwards along the eastern side of England, through Middlesex, Hertfordshire, Essex, Cambridgeshire, and Bedfordshire, occasionally reaching Norfolk, Nottinghamshire, and Lincolnshire; while the other area has its nucleus in North Wales and Shropshire, and tends to spread through Herefordshire and other bordering counties, as also in some years into South Wales, Monmouthshire, and even across the Bristol Channel into Somersetshire." The disease is more common on retentive than on porous soils; and is more fatal in the sparsely-peopled country districts than in the large cities; and a larger proportion of women than of men die of the disease.

The mortality from diphtheria varies greatly in different years, but it does not appear to have any relation to temperature or rainfall. Its annual prevalence does not bear any close relation to that of scarlet fever.

[1] Report, 1884.

Erysipelas causes an average mortality of about 95 per million. The deaths from this disease rise and fall, along with those from puerperal fever, in such a way as to show that there is a close affinity between them. It attains its maximum prevalence in the last quarter.

Diarrhœa, with which is included dysentery, occasioned an average annual death-rate of 653·4 per million persons living in the five years 1881–85. During the twenty years 1861–80, the average death-rate was 942 per million. It is notably a disease of infancy.

The average quarterly mortality for the ten years 1878–87 was as follows:—

First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.
0·24	0·28	1·90	0·45

Diarrhœa is the only zymotic disease which attains its maximum in the third quarter. Nearly one half of the deaths occur from July to September. The proportion of deaths from diarrhœa bears a constant relation to the temperature of the third quarter:—

	Death-rate from Diarrhœa in the Third Quarter.	Mean Temperature of the Third Quarter.
1876, ...	3·22	61·8
1877, ...	1·97	58·5
1878, ...	3·22	60·8
1879, ...	1·28	58·1
1880, ...	3·25	61·4

From this it appears that for every degree Fahrenheit above 58° there is an increase in the diarrhœal death-rate of about 0·6 per 1000 of the population. Wet seasons, perhaps because they are cold, show a small diarrhœal mortality.

Its relation to density of population is also well marked, as will be seen from the average of four years 1885–88:—

Twenty-eight great Towns.	Other Towns.	Rural Districts.
0·85	0·67	0·45

Diarrhœa is specially fatal in infancy; no less than 62·5 per cent. of the mortality occurs in children under one year of age.

The dysentery deaths, as distinguished from diarrhœa, averaged, from 1871 to 1880, 28 per million living.

Sporadic Cholera gave rise to an average death-rate of 18 per million in the ten years ending 1887. Like diarrhœa, it is especially prevalent in warm summers, and in the large towns. It is limited, as Sydenham says, to the month of August or to the first week or two of September.

Asiatic Cholera made its first appearance in England in 1831 breaking out in Sunderland on the 26th of October, having been

introduced from Hamburg, where it had been raging. It soon showed itself in Newcastle, North and South Shields, and Gateshead; and in January of 1832 it broke out in different parts of the south of Scotland, invading Edinburgh and Glasgow in February and March. It appeared in London about the 13th February, and spread over large districts of England, Wales, and Ireland. It reappeared in London and some other parts of the country in the summers of 1833 and 1834.

The second epidemy occurred in 1848–49, lasting seven months, from October 1848 to the following April.

The third epidemy broke out in 1853–54; and the fourth and last outbreak occurred in 1865–66.

The visitations of 1832, 1848, and 1854 were coincident with great atmospheric pressure, high temperature (except in 1832), small diurnal range, owing mostly to high night temperature, deficiency of rain, very little wind, few electric disturbances, and in 1854, and again in 1866, with the presence of a remarkable blue mist.

In 1866 the temperature was low, the daily range small, owing to low day temperature; there was abundance of rain, and the air was in constant movement. The meteorological conditions in the last epidemy were widely different from those prevailing during the first three outbreaks, and this was thought by some to be the cause of its diminished virulence.

Mr. Radcliffe remarks that "since the great outbreak of epidemic cholera in this country in 1832–33, an enormous development of diarrhœa has taken place in the metropolis as in the rest of the country generally." The tables he gives go back only to the year 1838, and there is nothing to show what the mortality was before 1832.

His figures prove that, for the quinquennial periods between 1841–65, the annual average deaths from diarrhœa per 10,000 of the population of London were as follows:—

1841–1845.	1846–1850.[1]	1851–1855.[1]	1856–1860.	1861–1865.
3·4	10·1	10·6	9·1	9·1

These figures certainly show an extraordinary increase of diarrhœa in the later quinquennial periods. The increase began by a sudden bound from 841 deaths in 1845 to 2152 deaths in 1846, that is, two years before the outbreak of the second epidemy. I confess I can see no reason to connect this rise in the diarrhœa death-rate in 1846 with the preceding cholera outbreak of 1832 or with

[1] Years of epidemic cholera. The deaths from cholera in 1865 were so few that they need not be taken into account.

the succeeding one of 1848; but the subject deserves further investigation.

The following points respecting cholera, as observed in London, deserve notice:—

(*a*) The disease has always been introduced into England from abroad.

(*b*) A subsidence of diarrhœa has been observed two or three weeks prior to the development of the epidemy (1848–49, 1853–54, and 1866).

(*c*) There has been an increase of diarrhœa during the epidemy.

(*d*) As a rule (in London), the mortality from cholera has been inversely as the elevation of the district assailed above the sea-level.

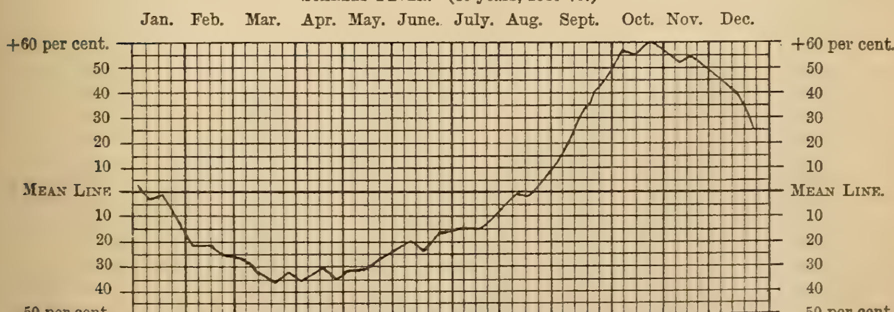
Typhus.—The deaths from typhus fever for the five years 1881–85 averaged 22·8 per million. It is most general in the northern counties, notably in Lancashire and Durham, in both of which counties the death-rate from this disease is above three times that of England and Wales. The mortality in typhus falls more heavily upon the ages between twenty and forty years.

Scarlet Fever, in the ten years ending 1880, caused a death-rate of 720 per million living. It attains its greatest frequency in the mining and manufacturing counties—Durham, Yorkshire, Northumberland, Staffordshire, Warwickshire, Cheshire, Lancashire, Monmouthshire, and South Wales; but this is partly to be accounted for by the large proportion of young children in the population of the industrial counties, the mortality from scarlet fever being highest in children under five years. In London the mortality from scarlet fever has, in late years, been under the average of England and Wales.[1]

The following diagram from the Registrar-General's Annual Summary, 1880, shows the weekly prevalence of scarlet fever:—

Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
7·4	4·6	5·1	3·4	3·8	6·1	8·3	12·5	13·6	14·3	12·5	8·4

Scarlet Fever.—(40 years, 1840–79.)



The mean line represents an average weekly number of 47 deaths.

[1] Annual Report of Registrar-General, 1884.

Measles.—In the ten years 1871–80, measles caused a death-rate of 379·4 per million, and was most prevalent in Lancashire, Devonshire, Monmouthshire, London, Cumberland, Leicestershire, and West Riding. We may judge that density of population has some influence in determining the prevalence of measles; but it is not the only cause, otherwise Devonshire and Cumberland would not occupy the places they do in the list.

The following interesting table is from the Registrar-General's Report of 1884, and shows the monthly distribution of deaths from measles in London, Paris, Berlin, in Scotch towns, and in certain groups of English towns:—

Monthly Distribution of Deaths from Measles per 1200 in the Year.

Months.	London, 1840–84.	Paris, 1865–69, 1872–83.	Berlin, 1875–83.	Scotch Towns, 1862–82.	Lancashire Towns, 1871–84.	Hull, Sheffield, Newcastle, 1871–84.	Bradford, Birmingham, Bristol, Brighton, Wolverhampton, 1871–84.
January, .	111	79	51	89	116	94	92
February, .	80	96	56	97	91	67	73
March, . .	88	87	65	114	107	100	105
April, . .	102	91	92	133	135	135	134
May, . .	110	123	185	145	120	130	136
June, . .	118	117	240	146	123	134	136
July, . .	105	165	202	132	101	121	94
August, .	89	119	78	80	74	90	87
September,	66	96	44	53	49	62	47
October, .	79	73	36	49	73	92	74
November, .	112	66	69	73	90	92	90
December, .	140	88	82	89	121	83	132
	1200	1200	1200	1200	1200	1200	1200

In Berlin, in the Scotch towns, and also in Hull, Sheffield, and Newcastle, the maximum mortality occurs from March to July. In Paris it is from May to August; in Scotland the rise begins in March. In London there is a winter rise from November to January—the maximum of the year being attained in December. In the Lancashire and the Bradford groups of towns there is a winter rise in December and January. Where there are two maxima, the mortality is naturally high; but why in certain localities and not in others there should occur two maxima, is quite unknown. "It is everywhere," says Hirsch, "the cold season in which epidemies of measles most commonly begin and in which they are apt to spread farthest." The universality of this rule is doubtful. The greatest mortality in Berlin and in Scotland falls in June; in Paris it occurs in July.

In a purely contagious disease, such as measles, it might naturally have been supposed that only three factors would have been required for its extension,—a source of contagion, a supply of susceptible persons, and the agglomeration of the susceptibles,—so that the contagion may be more directly carried from the sick to the healthy. But the problem is not quite so simple, otherwise there is no reason why the disease should not occur with equal frequency at all seasons. Mayr remarks "that the weather, the season of the year, as well as the nature of the other diseases which happen to be prevalent at the time, or have recently been epidemic, determine the character of the disease."[1] It is evident that season not only affects the type, but in some way also determines the prevalence of measles.

If we take the twenty-five years 1863–87, we find that the mean death-rates from measles per million living for the successive five-yearly periods were as under:—

1861–65.	1866–70.	1871–75.	1876–80.	1881–85.
456	428	373	384	410.

Now, if we take the mean of the last quinquennial for the two succeeding years 1886 and 1887, and arrange the individual years in two series according as they are above or below the mean of the respective quinquennials in which they occur, we find that in thirteen of these years the average of deaths was over, and in twelve years the average of deaths was under, the mean of their respective five-yearly periods.

The years when the deaths were in excess of the average of the five-yearly period were the following:—1863, 1866, 1868, 1869, 1871, 1874, 1876, 1880, 1882, 1884, 1885, 1886, and 1887. In the intervening years the deaths were less than the average.

The following table represents in how many of the years of the two series the temperature of the years and of the quarters were above or below the average:—

[TABLE

[1] Hebra, *Diseases of the Skin*, New Sydenham Soc. vol. i. p. 185.

Thirteen Years, between 1863 and 1887, in which the Death-rate from Measles was above the Average.

Table showing the number of these years in which the mean temperature of the year and of the several quarters was above or below the average temperature of thirty-nine years. The sign + shows the temperature to have been above, and the sign – indicates that it was below the average.

Number of Years.	Above or below Annual Mean Temperature.	Number of Years.	Above or below Average Temperature of First Quarter.	Number of Years.	Above or below Average Temperature of Second Quarter.	Number of Years.	Above or below Average Temperature of Third Quarter.	Number of Years.	Above or below Average Temperature of Fourth Quarter
8	+	9	+	5	+	9	+	6	+
4	–	4	–	8	–	4	–	6	–
1	average	...	...	...	...	...	...	1	average

Twelve Years, between 1863 and 1887, in which the Death-rate from Measles was below the Average.

Table showing the number of these years in which the mean temperature of the year and of the several quarters was above or below the average temperature of thirty-nine years. The sign + shows the temperature to have been above, and the sign – indicates that it was below the average.

Number of Years.	Above or below Annual Mean Temperature.	Number of Years.	Above or below Average Temperature of First Quarter.	Number of Years.	Above or below Average Temperature of Second Quarter.	Number of Years.	Above or below Average Temperature of Third Quarter.	Number of Years.	Above or below Average Temperature of Fourth Quarter.
7	–	8	–	3	–	7	–	6	–
5	+	4	+	9	+	5	+	6	+

From this table we see that measles are twice as often in excess of the mean when the temperature of the year is above the average; that in nine years out of thirteen, in which measles was in excess of the average, the temperature of the first and third quarters was also above the normal, while in only five out of the thirteen years was the temperature of the second quarter above the normal, and in eight years it was below the average. All this is reversed in the second series of years in such a way that one can scarcely look upon it as a coincidence. The inference is that a high temperature in the first and third quarters in some way increases the fatality of measles, and that a low temperature in these quarters reduces it. That a low temperature in the second quarter tends to increase, and a high temperature to diminish, the deaths from measles. That the temperature of the fourth quarter has no influence on the

mortality from this disease. The whole subject of the seasonal distribution of the eruptive fevers demands fuller examination.

Whooping-Cough, in the ten years 1871–80, occasioned a death-rate of 513·3 per million. It is most fatal in London; somewhat less so in the twenty-eight great towns; still less fatal in fifty other smaller towns, and least fatal in the rural districts. It is more fatal among females than males. It is most fatal from December to May.

Smallpox, for the ten years 1876–85, caused a death-rate of 78·2 per million, as against an average in the previous twenty years of 238·4. It is most fatal from January to June; attaining its maximum in May, and its minimum in September.

Influenza.—Although a certain number of deaths are registered yearly as occurring from this disease, a number varying from 3 to 39 per million, it is probable that these are really cases of bronchial catarrh. In the year 1866 the deaths from influenza were 31 per million, and Hirsch states that in that year there was an epidemy of the disease in London in the month of May. The following are the principal epidemies of influenza which have been recorded in England:—1510–81, by Thomas Short; 1658, by Willis; 1675, by Sydenham; 1693, by Molyneux; 1729, 1737, and 1743, by Huxham; 1732–33, by Arbuthnot; 1758, by Whytt; 1762, by Baker and Rutty; 1767, by Heberden; 1776, by Fothergill; 1782, by Gray and others; 1789–90, by Warren; 1803, by Pearson and Falconer; 1831, by Burne and others; 1833, by Hingeston and others; 1837, by Streeten, Graves, and others; 1847, by Peacock, Laycock, and others;[1] and finally, the epidemy of 1889–90, with a recrudescence in April and May, 1891.[2]

In the epidemies of 1658, 1762, and 1776, influenza assumed a remittent or intermittent character—usually tertian—either in its course or towards its decline. This has not been observed in recent epidemies since malaria has become so much less prevalent in England.

Phthisis.—The deaths registered from phthisis in the successive quinquennial periods from 1861 show a constant decrease:—

Deaths from Phthisis, 1861–1885, per Million living.

1861–65.	1866–70.	1871–75.	1876–80.	1881–85.
2526·6	2447·8	2218·0	2040·0	1820·6

[1] Thompson, *Influenza,* London 1890.

[2] The influence of the epidemy in augmenting the deaths from respiratory diseases, as well as the duration and march of the disease, will be seen from the following table from the Registrar-General's Report, showing the deaths in London from December 1889 to 8th February 1890:—

	December.				January.				February.	
	7.	14.	21.	28.	4.	11.	18.	25.	1.	8.
Respiratory Diseases,	432	552	518	467	843	1069	1010	736	550	485
Influenza,	..	..	..	..	4	67	127	105	75	38

It has been proved that sanitary improvements, especially the drainage of towns, have had a marked influence in reducing the death-rate from phthisis. Females are more liable to phthisis than males up to the age of 25, after that the sex liability is reversed. Phthisis is most fatal at the ages from 15 to 55.

The following table gives the distribution of the disease in the several counties, taking the average of the ten years 1871–89:—

Average Deaths from Phthisis in the Counties of England for the Ten Years 1871–80.

Dorsetshire,	1·72	Nottinghamshire,	1·96
Worcestershire,	1·48	Norfolk,	1·94
Rutlandshire,	1·42	Essex,	1·83
Herefordshire,	1·52	Cheshire,	2·01
Leicestershire,	1·77	Surrey (extra Met.),	1·91
Staffordshire,	1·60	Warwickshire,	1·95
Buckinghamshire,	1·69	Huntingdonshire,	1·93
Hertfordshire,	1·75	Cumberland,	2·20
Northamptonshire,	1·86	East Riding,	1·97
Somersetshire,	1·65	Durham,	1·93
Shropshire,	1·64	Sussex,	2·05
Derbyshire,	1·90	Suffolk,	2·02
Westmoreland,	2·03	Cambridgeshire,	1·99
Lincolnshire,	1·69	Devonshire,	2·07
North Riding,	1·69	West Riding,	2·26
Berkshire,	1·92	Cornwall,	2·20
Middlesex (extra Met.),	1·78	Lancashire,	2·47
Oxfordshire,	1·88	Hampshire,	2·20
Kent (extra Met.),	1·83	London,	2·51
Gloucestershire,	1·81	North Wales,	2·57
Monmouthshire,	1·79	South Wales,	2·54
Bedfordshire,	2·12	Northumberland,	2·27
Wiltshire,	1·74		

The mean death-rate from phthisis in England, for the ten years ending 1880, was 2·12; that of the male population being 2·21, and that of the female, 2·03 per 1000. It will be seen from the above table that the phthisis mortality was in excess of the mean in North and South Wales (excluding the counties of Radnor and Brecknock), in Lancashire, the West Riding of York, Cumberland, Northumberland, London, Hampshire, and Cornwall. In all the other counties the phthisis mortality was below the mean. As regards Hampshire, it has to be noticed that the deaths are abnormally increased by the location there of the naval and military hospitals, receiving patients from all parts of the world. The region of maximum prevalence will thus be seen to stretch along the western side of England, from Cumberland to Cornwall, extending into Northumberland. The disease is at its minimum in the central counties—Rutland, Worcester, Herefordshire, Staffordshire, and Shropshire.

The explanation of the comparatively low mortality from phthisis in these counties, is not to be found either in the sparseness of the population, or in the agricultural occupations of the inhabitants.

Overcrowding in badly ventilated houses, with the resulting pollution of air and soil, is undoubtedly favourable to the development of consumption; but the density of the population of a given county, as estimated by the number of acres or fractions of an acre to each inhabitant, affects in no appreciable degree the general distribution of the disease, although its influence may be evident enough in particular localities, especially in London and Liverpool. In Rutlandshire, where the mortality from phthisis is at its minimum, the acreage to each person is 4·63,—a proportion identical with that of North Wales, where the disease attains its maximum prevalence.

Nor can it be said that the entirely agricultural counties suffer least, for in Bedfordshire, which is purely agricultural, and three-fourths of which has a clayey soil, the consumption death-rate is higher than in the mining county of Durham, or in Staffordshire with its potteries; although the earthenware manufacture, next to tin mining, is the occupation of all others most conducive to the development of phthisis. The great differences observed in the death-rates of agricultural counties largely depend upon the character of the soil. Buchanan, in his inquiry into the relation of dampness of the soil to phthisis in Surrey, Kent, and Sussex, has shown that there is less phthisis on pervious, high-lying, and sloping soils than on impervious, low-lying, and level soils.[1]

The excess of phthisis in certain localities is obviously owing to the unhealthy industries carried on in the district. Thus, in Cornwall, consumption is found to be highly prevalent in the tin-mining districts, and in these the males, who work in the mines, suffer in a much higher proportion to the females than that which obtains in the country as a whole. So in Lancashire and the West Riding of York, the prevalence of consumption may reasonably be attributed, in part at least, to the cotton and woollen manufactures, which furnish employment to so large a part of the population, and which is known, by statistical evidence, to favour the development of the disease. In North and South Wales, where phthisis reaches its maximum, the case is different. Here the principal industries are coal, copper, and lead mining, and slate quarrying.

The consumption death-rate of slate and stone quarriers is high; and the same is probably true of copper and lead miners. Coal miners, on the other hand, enjoy a comparative immunity from phthisis; so much so, that some writers have claimed for coal dust the property of hindering the development and arresting the progress of consumption. That the slate, copper, and lead mining industries increase the death-rate from phthisis in North Wales is certain, but

[1] Privy Council Reports

the excess due to these industries does not explain its excessive prevalence there. The deaths from consumption are nearly as numerous in districts in which these occupations are not carried on as in those in which they are. If mining were the sole or principal cause of the high death-rate from phthisis in North Wales, we should expect the proportion of male deaths to be in excess of the female deaths, as in Cornwall and Lancashire. Such, however, is not the case. On the contrary, the male mortality from consumption in North Wales is 2·44, and the female rate 2·71 per 1000. In South Wales, again, where coal mining is the principal industry, phthisis is almost as fatal as in North Wales; and in the island of Anglesey, where only a small proportion of the population is engaged in mining, the male death-rate from phthisis is 3·28, and the female death-rate 3·43 per 1000.

It thus appears that no complete explanation can be given of the geographical distribution of phthisis in England. We have here to recognise the existence of a zone similar to that which is observed in the Rhine provinces of Germany, and at certain altitudes in Switzerland, in which phthisis, for reasons not yet understood, attains a high degree of prevalence.

The monthly distribution of deaths from phthisis in London, taking the weekly average for the thirty years 1845–74, was as follows:—

Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
154	153·25	160·2	162	157·25	150	144·75	136·50	132·4	135·75	146	147

It will be seen that the difference between the months, as regards the number of deaths, is far less marked than in the case of bronchitis.

Pneumonia caused, during the ten years ending 1880, an average death-rate of 1012 per million living. The proportion of deaths from pneumonia to deaths from all causes is about 52·8 per 1000. The proportion of males to females who die of pneumonia is 1289 to 966. As more females attacked by pneumonia die of the disease than males, it follows that the liability of males to the disease is much higher than the difference in the proportion of deaths in the two sexes indicates. The ages most liable are early childhood, and again the period of life after thirty-five. The sub joined table gives the distribution of pneumonia in England (average of three years) 1885–87; but as it is calculated on the basis of population for 1881, the figures will be somewhat in excess of the true ratios, especially in London and other rapidly-growing localities. It serves, however, to show, in a general way, the relative prevalence of the disease in different parts of England.

Average Distribution of Pneumonia in the several Counties of England (1885, 1886, 1887).[1]

Rutlandshire,	0·45	Herefordshire,	0·85
Wiltshire,	0·69	Shropshire,	0·85
Buckinghamshire,	0·70	East Riding (with York),	0·85
Westmoreland,	0·70	Middlesex (extra Met.),	0·86
Sussex,	0·71	Cumberland,	0·87
Hampshire,	0·72	North Wales,	0·87
Bedfordshire,	0·72	Northamptonshire,	0·90
Norfolk,	0·72	Worcestershire,	0·92
Dorsetshire,	0·72	Warwickshire,	0·95
Somersetshire,	0·73	Cornwall,	0·97
Lincolnshire,	0·74	Northumberland,	0·97
Nottinghamshire,	0·74	Devonshire,	0·99
Huntingdonshire,	0·74	Leicestershire,	1·00
Essex,	0·74	Cheshire,	1·01
Hertfordshire,	0·75	North Riding,	1·06
Oxfordshire,	0·76	Staffordshire,	1·07
Kent (extra Met.),	0·77	Durham,	1·08
Surrey (extra Met.),	0·78	London,	1·11
Berkshire,	0·80	West Riding,	1·19
Suffolk,	0·81	South Wales,	1·32
Derbyshire,	0·81	Monmouthshire,	1·52
Gloucestershire,	0·82	Lancashire,	1·59
Cambridgeshire,	0·84		

The disease is evidently more fatal in the densely peopled manufacturing and mining districts than in the agricultural counties. Those living out of doors in the same county are less liable to the disease than those whose occupations confine them to the house. In keeping with this, we find that prisoners are specially liable to suffer from pneumonia.

The annual fluctuation in the death-rate does not exhibit a constant relation to temperature; yet it is to be observed that the two out of the last twenty years when the mortality from pneumonia was lowest, viz. 1868 and 1872, were years in which the annual mean temperature was 2°·2 and 1°·4 in excess of the average. The winters of 1856, 1872, and 1877, again, were mild, and these were also years when the deaths from pneumonia were few. The cold year, 1879, was not marked, however, by a corresponding increase in the fatality of the disease, but still there was an increase over that of the preceding years. Then, again, the winter quarter of 1858 was characterised by great severity, and the deaths from pneumonia were much above the average. It cannot, I think, be doubted that pneumonia is, as a rule, most fatal in cold seasons.

The following is the average monthly temperature for the years

[1] Longstaff gives the following registration counties as those in which pneumonia is more fatal than bronchitis: S.W. Gloucester, Rutland, Surrey (extra Met.), Bedford, Cornwall, Monmouth, and Cambridge.—*Trans. Epid. Soc.* 1875–80.

1845–74, and the average number of deaths weekly, in London, for each month for the same period:—

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Average Mean Temperature,	38·6	40·1	42·2	48·6	52·7	60·0	64·2	63·5	59·1	52·2	44·2	40·5
Average Deaths from Pneumonia,	98	86	91	82	67	53	42	37	43	66	98	108

So closely does the pneumonic death-rate rise and fall with the temperature, that, if we were to confine our attention to England alone, we should be justified in concluding that the greater or lesser prevalence of pneumonia in any month was determined solely by the lower or higher mean temperature of that month.

But when we observe the seasonal distribution of the disease in other countries, the case assumes a somewhat different aspect. In Berlin, for example, during the ten years 1873–82, the maximum number of deaths from the disease occurred six times in April or May, twice in March, once in January, and once in June. In Stockholm, Copenhagen, and numerous other places, May is the month when pneumonia is most prevalent. In short, as a rule, it is in the comparatively warmer months of spring that the disease is most generally fatal. Many suppose that it is the rapid changes of temperature, rather than the degree of cold or heat in any season, that determines the prevalence of pneumonia, and it is stated that such changes are more common in spring in those places when the maximum is attained in April and May. But it must be observed that in England the deaths are most numerous in those months in which the daily range of temperature is lowest. Without going so far as to deny the influence of chill, arising from sudden changes of weather, as an exciting cause of pneumonia, we will hesitate to attach extreme importance to this cause, if we observe that in some countries, where the temperature is the most equable, as, for example, in the Bahamas and Cayenne, pneumonia is more than usually fatal among the coloured population. That the deaths from pneumonia in Rutlandshire should number 450, in Leghorn 1700, in Turin 2400 per million, cannot be adequately explained by any known peculiarities of weather. There is much in the clinical history, as well as in the distribution of pneumonia, that suggests its affinity to the miasmatic class of diseases. It is not at all improbable that more than one disease is included under the name of pneumonia.

Pneumonia, as we have already seen, becomes unusually prevalent in certain years, and this is sometimes clearly owing to the severity of the season; but a disease known as pneumonia has repeatedly been observed to become so general as justly to be

regarded as epidemic, and under such circumstances it has often exhibited typhoid symptoms,—great nervous prostration, stupor, and delirium,—and has been thought by many to have a contagious character.[1]

These epidemies may be arranged under three categories—(1) Those limited to public institutions, and generally connected with overcrowding. (2) Those confined to a particular locality. (3) Those coinciding with or preceding or following similar outbreaks in other localities, or invading larger areas, and extending sometimes over several successive years. Whether these classes are all of the same nature, and whether one or all of them are simple varieties of ordinary pneumonia, it is at present impossible to decide. Pneumonia becomes exceedingly fatal during epidemies of influenza.

Pleurisy does not give rise to a great proportion of deaths, the average death-rate in the ten years ending 1880 being only 49 per million.

The geographical distribution of pleurisy is widely different from that of pneumonia. Taking the average of the three years 1885–87, the counties where the death-rate reached 70 per million were London, Cornwall, Rutlandshire, Lancashire, and Northumberland. Herefordshire headed the list with an average of 80 per million.

Bronchitis takes the first place among the causes of death in England; and whether from greater exactness in diagnosis, or from some other cause, the registered mortality from bronchitis has been increasing instead of diminishing. In the five years 1850–54 the average death-rate was 1016·4 per million; in the five years 1875–79 it had risen to 2464·6 per million; and during all the intervening five-yearly periods there was a steady rise. It is at the ages under five, and again at those above fifty-five years, that the mortality is greatest. From five to fifteen, females suffer more than males; at all other age periods, bronchitis is more fatal to males. Its regional distribution will be gathered from the following table:—

[1] In 1888 there was an epidemy of pneumonia at Middlesbrough, which was investigated by Dr. Ballard for the Local Government Board. The population is under 70,000; but there were 369 fatal cases, and probably not fewer than 1000 persons were attacked. Dr. Klein found that he could reproduce the pneumonia in rodents by inoculating them with the morbid material taken from the lungs of patients, and from this matter could cultivate a bacillus which had the power of inducing the disease.

Average Death-rate in the Counties of England from Bronchitis, 1885–87.

Rutlandshire,	1·20	Huntingdonshire,	1·94
Surrey (extra Met.),	1·37	Oxfordshire,	1·95
Westmoreland,	1·45	East Riding (with York),	1·95
Kent (extra Met.),	1·49	Durham,	1·95
North Riding,	1·61	Hampshire,	1·98
Bedfordshire,	1·62	Buckinghamshire,	1·98
Cambridgeshire,	1·62	Cumberland,	1·98
Suffolk,	1·63	Derbyshire,	1·99
Lincolnshire,	1·65	Dorsetshire,	2·02
Northumberland,	1·65	Essex,	2·04
Herefordshire,	1·73	Somersetshire,	2·07
Berkshire,	1·74	Nottinghamshire,	2·09
Sussex,	1·76	Devonshire,	2·09
Middlesex (extra Met.),	1·78	Cheshire,	2·12
Worcestershire,	1·79	Wiltshire,	2·14
Hertfordshire,	1·81	Gloucestershire,	2·15
South Wales,	1·83	West Riding,	2·30
Shropshire,	1·84	Warwickshire,	2·34
North Wales,	1·87	Staffordshire,	2·39
Leicestershire,	1·88	London,	2·53
Northamptonshire,	1·89	Lancashire,	2·72
Cornwall,	1·90	Monmouthshire,	2·82
Norfolk,	1·92		

The annual prevalence of the disease is to a considerable extent determined by the weather. Thus we find that in the unusually warm seasons 1865, 1868, and 1872, the death-rates from bronchitis were exceptionally low; while the years 1871, 1875, and 1879, when bronchitis was unusually fatal, were years when the mean annual temperature was below the average.

The following shows the average weekly deaths in each month in London from bronchitis for a period of thirty years, 1845–74:—

Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
193·5	172·5	165·0	127·5	90·0	63·2	48·2	41·0	48·2	76·5	141·2	190·2

The mortality from bronchitis in London is thus seen to stand in an inverse relation to the temperature; and although the data on the subject are inadequate, it would appear that generally all over the world the months when the weather is cold and changeable are those in which bronchitis is most prevalent. The prevalence of bronchitis is determined much more by the quality of the inspired air than by its temperature. It is thus we find bronchitis to be specially fatal in cities where large numbers are employed in badly ventilated and over-heated rooms, and especially where the workmen have to breathe a dust-laden atmosphere. Those engaged in earthenware, cotton, linen, and woollen manufacture are particularly liable to suffer from bronchitis; while fishermen, farmers, graziers, and agricultural labourers, although continually exposed to the inclemencies of the weather, are the classes that pay the smallest tribute to bronchial affections.

Croup.—The only other disease of the respiratory organs which we shall notice is croup, which, in the ten years ending 1880, furnished an average death-rate of 170 per million. As the distinction between croup and diphtheria is not universally acknowledged, what to one is a case of croup is to another a case of diphtheria. The statistics, therefore, relating to the disease are of comparatively little value. The mortality is higher on the western than on the eastern side of the country. The first and last quarters are those in which most deaths occur; the third quarter has the fewest deaths from croup. In London the greatest mortality falls on the fourth quarter.

Diseases of the Liver and Spleen.—The deaths from disease of the liver, other than cirrhosis, in 1887 were 194 per million living. The deaths from disease of the spleen gave a ten years' average (1871–80) of 4·5 per million.

Diabetes causes an average of 50·8 deaths per million.

Rheumatism.—The death-rate from rheumatic fever, rheumatism of the heart, and rheumatism combined, for the four years 1881–84, was 130·2 per million; that from rheumatism alone was 35·5. In Ireland the death-rate from rheumatic fever and rheumatism of the heart is 20·2, while rheumatism is credited with 124·6 per million. In New South Wales the mortality from rheumatic fever and rheumatism of the heart is about 35 per million, while in Switzerland rheumatic fever gives rise to 26 deaths per million living. The Collective Investigation Committee of the British Medical Association found that acute and sub-acute rheumatism was universally prevalent all over the British Islands and Ireland in such a way that there is no district where the disease is not common.[1] Rheumatic fever is most fatal between 10–20 years of age, and attains its maximum in the fourth quarter.

Cancer caused an average death-rate of 544·6 per million for the period 1881–85. Like rheumatism, it is generally diffused over the three kingdoms. In Scotland it appears that the disease is somewhat less prevalent in the south than in the north; but in England, Wales, and Ireland the disease is distributed in a tolerably uniform manner, occurring alike along the coast and inland, in mountainous districts and on plains. The disease is not observed to follow the course of rivers, or to be affected by geological formation; it affects indifferently the poor and rich, and occurs with equal frequency in agricultural and industrial districts.[2]

[1] *Brit. Med. Journal*, Jan. 19, 1889.

[2] It deserves to be noticed, however, that the Registrar-General has pointed out that cancer, during the thirty years 1857–80, has been most fatal in London, the south-

A gradual increase of cancer mortality has been observed in the successive decennia since 1851, common to both sexes, but considerably greater in the case of males than of females, and at all age periods. The Registrar-General points out that the liability to death from cancer increases much more rapidly than the liability to death generally up to the 45–55 years period; but that in the later age periods the general mortality increases more rapidly than the cancer mortality; "the characteristic feature of cancer mortality is not its increase with advance of age,—for this it shares with other fatal affections,—but its disproportionate increase in the middle periods of life."

Tabes Mesenterica.—The death-rate from tabes mesenterica, which may be taken to include all wasting diseases of infancy, was 0·32 per 1000 for the ten years 1871–80. Amongst the severely affected counties, Durham heads the list with a death-rate of 0·75; Northumberland follows with 0·62; Nottingham, with 0·41; London, with 0·40; the West Riding, with 0·38; Staffordshire and the East Riding, with 0·35; and Lancashire, with a rate of 0·34 per 1000. The counties with the lowest death-rates from this disease were Rutland, Hereford, and Berkshire. North and South Wales, which suffer so severely from phthisis, show a low death-rate from *tabes mesenterica.* The view that tabes mesenterica is mainly caused by the improper feeding of infants, is not inconsistent with what we know of its incidence in the different districts of England.

Hydrocephalus is another fatal disease of infancy, causing an average death-rate of 0·32 per 1000; the male mortality being 0·38, and the female, 0·26 per 1000. The maximum mortality, 0·45, occurs in Durham, as is the case in tabes mesenterica. The deaths are also in excess in Cumberland, London, Northumberland, the West Riding of York, and Lancashire; and they are below the mean in Rutland, Shropshire, and Norfolk. Whatever may be the cause or causes of this disease, they are general throughout the county of Durham, where, out of fourteen districts, the disease is below the average in one only.

Scrofula.—The mean mortality in England from scrofula, from 1871–80, was 0·13 per 1000,—a proportion about double that of Switzerland, and somewhat above that of Germany. Oxford, which registers the greatest number of deaths from scrofula, has a ratio of

eastern and south-midland divisions, and least fatal in Wales, the north-midland and the north-western divisions. The high mortality of London is partly explained by it being a place to which persons resort when surgical operations are required.—Annual Report, 1884.

0·19 per 1000; Monmouth stands next with 0·17; London and Norfolk follow with rates of 0·16; while in Buckingham, Hereford, Worcester, and Rutland the death-rate is as low as 0·08 per 1000. It will be seen that the geographical distribution of scrofula differs considerably from that of phthisis. In Norfolk, Monmouth, and Oxford, where scrofula is prevalent, the mortality from phthisis is below the mean. In North Wales, on the other hand, where consumption is so fatal, scrofula is rather rare. In Anglesey the phthisis death-rate stands at 3·36 per 1000, while that of scrofula is as low as 0·06.

It would appear that the prevalence of scrofula is mainly determined by purely local conditions, and not by climate. Thus the Headington district of Oxford has perhaps the highest scrofula death-rate in England, viz. 0·48; while in the immediately adjoining district of Oxford proper the rate is 0·12, which is below the average of England. In Monmouthshire, again, we find the excess of scrofula to be limited to one or two districts, and notably to the densely peopled mining district of Bedwelty, including Tredegar, where it reaches the figure of 0·34 per 1000. In London the disease makes most victims in the overcrowded slums of the Strand, St. George's in the East, and Whitechapel. In Norfolk the districts most affected are Blofield, Downham, and Thetford.

Rickets give rise to 22 deaths per million. This disease is comparatively rare in the rural districts, being mainly a disease of towns and industrial regions; but it is exceptionally prevalent in Cornwall, Kent, and North Essex.

Venereal Diseases gave rise to a mortality of 62·7 per million in the three years 1858–60, to 77·4 per million in the five years 1861–65, and reached 95·6 per million in 1876–80. This class of diseases has thus been steadily increasing in fatality of late years.

Hydrophobia causes an average death-rate of about 1 per million. It has two centres of prevalence,—the one in Lancashire, radiating into the neighbouring counties of Cheshire and the West Riding, gradually diminishing as the distance from the centre increases. The second centre consists of London, from which the disease extends into the extra metropolitan portions of Middlesex, Surrey, and Kent, and then shades off in the wider belt surrounding this area.

CHAPTER X.

SCOTLAND.

Geography.—Scotland occupies the northern part of Great Britain, extending from 54° 39′ to 58° 40′ N. lat. To the north of the mainland lie the Orkney and Shetland Islands, reaching as high as lat. 60° 50′ N. The Hebrides, divided into an inner and outer group, stretch along the west coast, which is extensively indented by deep firths.

As we do not propose to enter in detail into the pathology of Scotland, but rather to point out those particulars in which it differs from the southern part of the island, it will be unnecessary to do more than note in a few words the chief physical features of the country which distinguish it from England.

The country may be described as mountainous. Even the lowlands are more boldly undulating than the southern part of the island. The extensive low and level plains, which occupy so large a part in the topography of the south, are here replaced by hill and dale.

In the south are the Cheviot Hills; in the middle are the Grampians, running obliquely across the country from Argyleshire to Aberdeen, having an average elevation of from 2000 to 3000 feet, and rising in Ben Nevis to a height of 4406 feet. Beyond the narrow and deep depression of Glenmore, which here intersects the island, and through which passes the Caledonian Canal, there extends northward a rugged mountainous region, terminating in the plain of Caithness.

The country abounds in inland lakes, which together are estimated to cover an area of 500 square miles.

The principal rivers are the Tay, Tweed, Clyde, Spey, Dee, Forth, and Don; and it is in the basins of these rivers and in the Forth and Clyde plain that we find the greatest extent of level land.

Many of the straths (valleys), now drained and highly cultivated, were formerly marshes and quagmires.

Climatology.—The mean annual temperature of Scotland is about 46·2. The west coast is, generally speaking, about a degree warmer than the east.

THE MEAN ANNUAL TEMPERATURE AND RAINFALL OF EAST, WEST, AND CENTRE OF SCOTLAND.

Localities and Altitudes.	Temperature and Rainfall.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Means and Totals.	Years.
Dalkeith, 190 ft., .	Temperature,	37·1	39·0	41·1	45·7	49·9	56·2	58·9	58·2	53·8	47·0	40·1	38·1	47·1	20
Edinburgh, 230 ft.,	Rainfall, . .	2·55	2·16	1·64	2·00	1·92	2·13	2·88	3·11	2·88	2·17	2·52	2·36	28·32	—
Culloden, 104 ft., .	Temperature,	37·2	38·9	40·2	45·4	49·1	55·1	57·8	57·1	53·1	46·9	40·1	38·0	46·6	19
	Rainfall, . .	2·30	1·53	1·60	1·48	1·63	1·94	2·69	2·88	2·82	2·39	2·53	2·08	25·87	—
Greenock, 233 ft., .	Temperature,	38·8	39·5	40·6	46·0	50·2	56·1	58·5	57·9	53·9	47·8	41·5	39·6	47·5	20
Glasgow, ...	Rainfall, . .	4·80	3·83	2·57	2·41	2·18	3·09	3·46	3·99	4·32	4·31	3·65	4·47	43·08	15
Perth, 48 ft., . .	Temperature,	37·2	39·1	40·6	46·0	50·4	56·3	59·7	58·4	54·0	47·3	40·3	38·1	47·3	20
	Rainfall, . .	3·69	2·24	1·99	2·19	2·12	2·22	2·74	3·52	2·98	3·00	2·67	2·74	32·10	—
Fettercairn, 247 ft.,	Temperature,	35·2	36·8	38·7	44·1	48·8	54·7	57·4	56·5	51·9	45·5	38·9	35·9	45·4	20
	Rainfall, . .	3·44	3·18	1·92	2·46	2·01	2·34	2·94	3·33	3·43	3·97	3·42	3·90	36·34	—
Sandwick (Orkney), 100 ft.,	Temperature,	38·9	39·1	39·2	43·2	46·6	52·3	54·7	54·8	52·0	47·0	41·7	40·0	45·8	20

The average annual rainfall of Sandwick in Orkney is 37·79; of Carsphairn in Kirkcudbright, 61·48; of Loch Dhu in Perthshire, 82·73 inches.

The rainfall on the east coast averages from 25 to 28 inches, and on the west coast from 27 to 60 inches; the heaviest rainfall is in summer and autumn.

VITAL STATISTICS.—The average marriage-rate for the ten years ending 1887 was 13·2 per 1000; the birth-rate, 33·1 per 1000; and the death-rate, 19·6 per 1000. In 1886 the death-rate of the entire country was 18·6,—that of the principal towns being 21 per 1000, that of the large towns 19·2, that of the smaller towns 18·1, that of the mainland rural districts 15·7, and that of the insular-rural districts 15·4 per 1000. The mean monthly distribution of deaths during the ten years 1871–80 was as follows:—

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1154	1061	1138	1064	1040	939	921	893	834	885	949	1122

December, January, and March are the months which are most charged with deaths; while August, September, and October are the healthiest.

PATHOLOGY.—*Malaria.*—Up to the beginning of the present century, malaria was endemic in some of the more marshy localities. The "How of the Mearns," a broad and shallow valley lying between the Grampians and the Garvock Hills, with a clayey subsoil, and so level as to render drainage difficult, was an endemic haunt of malaria even so late as 1815 or thereabouts. Labourers who went from the coast districts to work in the "How" during harvest generally returned home with ague. I doubt if a single case has been observed in this locality for the past fifty years—so completely has drainage and cultivation banished the disease. This is only an example of what has taken place all over the country.

I know of no locality in Scotland where ague can be said to be endemic at the present time. In 1885 ague caused 9 deaths in Scotland, of which 7 were males and 2 were females. This gives a death-rate of 2·3 per million. In the succeeding year the deaths from ague were much more numerous—no fewer than 17 deaths having been recorded from this disease in 1886, of which 13 were males and 4 were females, being a death-rate of 4·3 per million. This great excess of males makes it probable that some of the cases had occurred in sailors or others who had contracted the disease abroad. In 1885, 4 out of the 9 male deaths occurred in seaport towns, in which no females died of ague. In 1886 only 2, or at most 3, of the deaths occurred in large seaport towns; although it is not improbable that some of the deaths that occurred in the inland towns or rural districts may have been imported ones. This is a point, however, on which we have nothing to guide us.

Clackmannan, a comparatively small county on the Forth, takes the first position as regards ague, and Inverness ranks second. In the other counties the cases are solitary.

Remittent Fever caused 30 deaths in 1885 and 17 in 1886, equal to ratios of 7·6 and 4·3 per million respectively.

Enteric Fever gave rise in 1885 to a death-rate of 230, and in 1886 to one of 190 per million. The moderately large towns and the smaller towns suffer very considerably more than the great towns, and these again suffer more than the mainland and insular-rural districts. Typhoid fever appears to be about equally common in Scotland and in England. The monthly distribution per cent. of 3548 fatal cases in the principal towns of Scotland, for the ten years 1876–85, was as follows:—

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
8·51	7·69	7·41	7·38	8·85	7·41	5·92	7·41	9·64	11·70	8·71	9·36

The highest mortality occurs in September and October, just as in England and in most parts of Germany, Switzerland, in Paris, and in Norway.

Relapsing Fever has been frequently epidemic in Scotland. Omitting the outbreaks during the eighteenth century, it was epidemic in 1799–1800, 1817–19, 1826–27, 1841–44, 1847–48, and in 1868–73. Most of these outbreaks were coincident with epidemics of the disease in Ireland. In 1885 and 1886 only 3 deaths were registered from this fever.

Diphtheria caused an average death-rate of 230 per million in Edinburgh and Glasgow in the years 1885–88. In the great English towns, for the same period, the death-rate from this disease was 180. For the whole kingdom the death-rate in 1885 was

180, and in 1886 it was 150 per million. It thus appears to be somewhat more fatal in Scotland than in England. The largest towns suffer most, the insular-rural and rural districts least. The distribution of diphtheria in Scotland will be seen to differ from that which is observed in England, where the sparsely peopled localities present the highest diphtheritic death-rates.

The death-rate from *Erysipelas* was 90 per million in 1885, and 70 in 1886. Its distribution is not materially influenced by density of population.

Diarrhœa is less fatal in Scotland than in England. In Edinburgh and Glasgow the death-rate averaged 0·59 per 1000 for the four years ending 1888; while in the great towns in England, for the same period, it was 0·85. The deaths from diarrhœa and dysentery for the whole of Scotland in 1885 gave a ratio of 0·42, and in 1886 of 0·47, per 1000. The fatality of the disease is in proportion to the density of the population.

Enteritis gives rise to 0·22 deaths per 1000, or 225 per million living, — a proportion considerably in excess of that observed in England, where, in 1884, the ratio was 119 per million living.

Scotland has not escaped when *Cholera* has been epidemic in the southern part of the island.

Typhus gives rise to a death-rate of about 0·025 per 1000. It is chiefly met with in Glasgow, Greenock, and Leith. The following is the monthly distribution per cent. of 1277 cases occurring during ten years ending 1885:—

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
10·26	9·63	10·26	8·93	10·65	7·75	6·97	6·81	6·57	5·63	7·67	8·85

Smallpox, from 1855 to 1874, caused a high mortality compared with the period 1875 to 1887. The average death-rate from this disease, during the ten years ending 1887, was 34 per million living, as against 53 per million in England.

Measles and *Scarlatina* affect Scotland in about the same degree as England.

Whooping-Cough is quite as common in Scotland as in England. It is more fatal in the towns than in the rural districts.

Phthisis causes an average death-rate of 2045 per million (1885–86), which is a considerably higher rate than that of England. The disease is most fatal in the large towns, less so in the small towns, and least of all in the rural districts.

The death-rate from *Pneumonia* in 1885 was 1150 per million, and in 1886 it fell to 1030 per million. Its fatality is greatest in the large towns, and is at its minimum in the country districts.

Indeed, it is three times as prevalent in the principal towns as in the insular-rural districts, which are chiefly situated in the north. Thus in 1886 the ratio per million was 1440 in the principal towns, and 480 in the insular-rural districts.

Pleurisy causes a death-rate of 84 per million, which is more than a third higher than that of England.

Bronchitis caused, in 1885, 2050 deaths per million; in 1886 the ratio was 2030. Thus, like most chest diseases, it is less fatal in the rural than in the urban districts. The proportions per 100,000, in 1886, were as follows:—In the principal towns, 257; in the large towns, 209; in the small towns, 180; in the mainland-rural districts, 145; and in the insular-rural districts, 116. This is conclusive evidence of the influence of occupation, habits, and social condition on the fatality of bronchitis.

Croup gives rise to the same death-rate in Scotland as in England—170 per million living.

Diseases of the Liver, other than cirrhosis, occasioned, in 1885, 196 deaths per million, which is practically the same as in England.

Diseases of the Spleen causes 4·7 deaths; *Cancer*, 575 deaths; *Diabetes*,[1] 16·2 deaths; and *Rheumatism*, 115 deaths, per million. The death-rate from diabetes is less than a third of the English death-rate from this disease,—a fact which at present does not admit of explanation. In 1886 the deaths from cancer in Scotland were in the ratio of 59 per 100,000 living. The ratio in the principal towns was 58; in the large towns, 61; in the small towns, 58; in the mainland-rural districts, 61; and in the insular-rural districts, 59. The disease is for some reason very unequally distributed over the principal towns. Thus, in 1866, the ratio of deaths from cancer per 100,000 living was in Edinburgh, 94; in Glasgow, 52; in Dundee, 59; in Aberdeen, 64; in Leith, 56; in Paisley, 52; in Perth, 25; and in Kilmarnock, 82. It would thus appear that the east of Scotland is more affected with cancer than the west or centre.

The remote island of St. Kilda, with a population, in 1881, of 77 souls, is subject to three diseases,—trismus neonatorum, probably due to the vitiated atmosphere of their huts; a species of dysentery, attributed to their use of sea-fowl as food; and the peculiar influenzoid disease called by them "boat cough," which is intimately associated with the arrival of strangers on the island.[2] This is precisely what is observed in Iceland and the Faröe Islands.

[1] Mean of 1885–86. Newsholme, however, gives the mean annual mortality in England as only 26 per cent. above that of Scotland,—a ratio which is probably based on the returns for a larger number of years.

[2] Morgan, *Brit. and For. Med. Chir. Rev.*, Jan. 1862.

CHAPTER XI.

IRELAND.

GEOGRAPHY.—Ireland lies between lat. 51° 26′ and 55° 23′ N., and long. 5° 20′ and 10° 26′ W. Its area is 32,524 square miles, with an estimated population, in 1887, of 4,837,313 inhabitants.

The hills are arranged in irregular, interrupted clusters round the coast. The highest peaks, rising from 3000 to 3400 feet above the sea, are met with in Kerry.

The central plain extends between the bay of Galway on the west and the bay of Dublin on the east, and from Lough Neagh on the north to Waterford on the south. Excepting where broken in upon by hills towards the south, the general level of the plain is less than 300 feet above sea-level.

The soil is, in part, of clay and gravel, resting upon limestone; but a great extent of the plain consists of peat bog. These peat-bogs, which are not confined to the plain, but are also met with in the uplands, are estimated to cover an area of 1,772,450 acres. The lakes are numerous; the principal being Lough Neagh, Lough Erne, and Lough Corrib. Some of the loughs are rather arms or inlets of the sea, than lakes properly so called. The principal rivers are the Shannon, Barrow, Blackwater, Bann, Boyne, and Liffey.

CLIMATOLOGY.—The mean temperature in the south of the island is 51°·5; in the north it falls to 48°·5. The mean temperature of winter is about 41°·5; of spring, 47°·0; of summer, 60°; and of autumn, 51°.

The average mean temperature and rainfall of Dublin for the eleven years ending 1880 was as follows:—

	Temperature.	Rainfall.
January,	40·4	2·109
February,	41·6	2·196
March,	43·0	1·856
April,	46·6	2·087
May,	50·8	1·636
June,	56·4	2·193
July,	59·6	2·752
August,	58·6	3·018
September,	54·4	2·376
October,	49·3	3·783
November,	43·7	2·364
December,	39·5	2·447
	48·7	29·017

Vital Statistics.—The average marriage-rate for the ten years ending 1887 was 8·6 per 1000, as against a marriage-rate in England of 14·8; the birth-rate for the same period was 24·4; and the death-rate, 18·4.

Pathology.—*Malaria.*—Malarial fever is still rarer in Ireland than in England or in Scotland. In each of the years 1878 and 1879, we find four deaths from ague recorded, and in 1880 and 1881, two and three deaths respectively. This immunity from malaria is all the more remarkable, from the fact that so large a portion of the surface is covered with bog. This seems to show that peat bog is innocuous, but we must not assume that other marshes are equally harmless. Graves says: "Formerly ague was of rather common occurrence in some marshy districts in the immediate vicinity of Dublin, and consequently, when I was a pupil, cases of intermittent fever were constantly to be met with in the hospitals; now the low ground has been drained, and thus the production of malaria has been entirely arrested."[1]

Fevers.—The fever death-rate of Ireland for the years 1871–80 was 567·8 per million living. This includes typhus, enteric, and simple continued fevers. These fevers during the same period caused a death-rate of 490 per million in England. While the total number of deaths ascribed to fever is probably correct, the proportions in which the individual forms prevail is less certain, as it may reasonably be assumed that the term "simple continued fever" includes many cases of enteric fever, and it is not improbable that a certain number of typhoid cases are returned as typhus. Taking, however, the returns as we find them, we observe that in 1881, out of 2446 fever deaths, there were 859 ascribed to typhus, 813 to typhoid, and 774 to simple continued fever; which gives for that year of 166·7 for typhus, 158·0 for typhoid, and 150·0 per million from simple continued fevers. Even allowing for inaccuracies in the returns, it is evident that typhus occupies a very important position in the pathology of Ireland compared with that which it holds in England, or, we may say, with any country in Europe. Typhoid fever, on the other hand, is probably less frequent in Ireland than in England or in Scotland.

Relapsing Fever, as we have already seen when treating of Scotland, has been frequently epidemic in Ireland, but at the present day it is seldom met with.

Diphtheria gave rise to a mortality of 64 per million in the ten years ending 1880, as against a ratio in England during the same period of 120 per million living. During the decennium ending

[1] Graves, *Clinical Lect.*, Syden. Soc. Ed., London 1885.

1880, scarlet fever, measles, erysipelas, and, we may add, whooping-cough, were considerably less fatal than in England.

Diarrhœa and Dysentery combined are by no means frequent in Ireland. From 1871–80 the average number of deaths ascribed to these diseases was 2064. Taking the mean population of the country during that period at 5,299,106, the death-rate would be 389·5, as against that in England for the same period of 910 per million living. Dysentery, on the other hand, taken by itself, appears to be considerably more fatal in Ireland than in England; the average dysenteric death-rate for the three years 1878–80 having been about 36 per million, as against the English average (1871–80) of 28 per million.

Sporadic Cholera caused an average mortality in Ireland of 13·8, while in England the rate was 30 per million.

The tubercular class of diseases, including phthisis, tabes mesenterica, and hydrocephalus, is somewhat less fatal in Ireland than in England, and *Scrofula* is about equally frequent in the two countries. The death-rate from consumption (1871–80) was 1954 per million.

Pneumonia.—The average number of deaths from pneumonia during the four years 1878–81 was 2291. If we assume that the average population during this period was 5,223,875, which if not exact is not wide of the mark, we get a death-rate of 438·5 per million, as against an average in England of 1012. To what are we to ascribe this remarkably low death-rate from pneumonia in Ireland? We have seen that pneumonia is, as a rule, more common in overcrowded manufacturing and mining localities than in agricultural districts; and the proportionally larger number of the population following agricultural pursuits in Ireland doubtless tells in a diminished pneumonic death-rate. The mild and equable character of the climate may also be supposed to contribute to the same result; but, as bearing upon the question of the influence of climate on pneumonia, it must be borne in mind that pleurisy, which gives rise to a death-rate of 49 per million in England, is credited with a mortality of 59·7 per million in Ireland. Why, it may be asked, should the mild climate have the effect of reducing the pneumonic and at the same time increasing the pleuritic mortality? If climate has any influence upon the death-rate from pneumonia, one would expect that it would tell still more in reducing the death-rate from *bronchitis*; but this is by no means the case, for bronchitis causes only a slightly smaller death-rate in Ireland than in England. Thus in the four years 1878–81, the average annual number of deaths from bronchitis was 12,190, which, taking the average population

at 5,223,875, would give a ratio per million of 2315·3. That this is approximately correct, is evident from the fact that in 1881, when the population was accurately known, the mortality from bronchitis was 2270·5. In England the death-rate from bronchitis was 2464·6 per million during the period 1875–79. Such a difference as exists between the death-rates in the two countries scarcely requires us to resort to a climatic explanation, while we bear in mind the influence of occupation on the prevalence of this disease.

Rheumatism.—Rheumatism of the heart and rheumatic fever caused a mortality in 1881 of 20·7, and rheumatism of 124·6, or a combined ratio of 144·8, compared to the English average of 131·8, per million. Is it that the greater exposure to weather, incident to agricultural life, tends to develop rheumatic and pleuritic, and perhaps bronchitic affections, while they do not have this effect on pneumonia; or is there something in the habits of the people as regards food which favours this prevalence of rheumatic diseases?

Diabetes is much less prevalent in Ireland than in England. The mean mortality in England from this disease exceeds that of Ireland by 40 per cent.[1]

[1] Newsholme, *Vital Statistics*, Lond. 1889.

CHAPTER XII.

THE NETHERLANDS.

GEOGRAPHY.—The kingdom of the Netherlands is situated between 50° 43′ and 53° 36′ N. lat., and between 3° 22′ and 7° 16′ E. long. It is bounded on the east by Germany, on the north and west by the North Sea, and on the south by Belgium.

It is to a great extent formed by the Rhine; so that Holland may be said to be "the gift of the Rhine," as Egypt is of the Nile. It is a level, or rather, as the name implies, a hollow country, many parts being below the level of the sea, and protected from its inroads either by sand-hills or embankments. Canals and rivers intersect it in all directions. The country presents numerous drained lakes called "polders," and there still exist not a few undrained morasses. The Zuyder Zee, fringed by islands, penetrates deeply into the north-western part of the country. The only portions that are at all elevated are the provinces of Drenthe, Overyssel, and parts of Gelderland and Utrecht. This tract of country has in many places a light sandy soil, is well watered, and carefully cultivated. The soil of Holland generally is clay, superimposed on banks of sand, marine shells, and beds of peat and clay. The soil of Walcheren is described as consisting of a fine white sand and a third part of clay. Rosendaal and Oosterhout, in North Brabant, where the British troops suffered so severely from malaria in 1794, are described as level plains of sand, perfectly dry on the surface, but permeated with water a few inches underneath, and covered only with a few stunted heath plants. The soil of Holland generally is charged with humidity at all seasons, and surcharged during heavy rains, or after inundations. The rivers are the Rhine, the Maas, and the Scheldt, with the Yssel, the Leck, and the Waal, forming numerous intercommunications, either directly or by means of canals.

The kingdom of the Netherlands is divided into eleven provinces, having an area of 12,597 square miles, and a population on 31st December 1886 of 4,390,857.

The subjoined table gives the population of each province at that date, and the death-rate per 1000 for 1887:—

	Population.	Death-rate per 1000.
North Brabant,	500,315	23·34
Gelderland,	502,049	20·39
South Holland,	911,534	23·36
North Holland,	786,116	22·05
Zeeland,	198,567	19·51
Utrecht,	212,454	21·97
Friesland,	335,597	18·78
Overyssel,	291,462	22·60
Gröningen,	270,608	18·18
Drenthe,	127,309	20·09
Limburg,	254,846	21·14
	4,300,857	21·60

Climatology.—The mean temperature of Utrecht and Gröningen is as follows:—

	Lat.	Altitude in Metres.	Jan.	April.	July.	Oct.	Year.
Utrecht,	52° 05′	13	1·5	9·4	18·4	10·4	9·9
Gröningen,	53° 15′	15	0·8	8·3	18·1	10·0	9·4

The average monthly rainfall at Utrecht, for a period of forty years ending 1888, in millimetres is as follows:—

Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
48·9	44·4	44·5	37·9	49·4	54·8	75·4	81·1	66·0	73·0	59·4	61·2

The climate is variable, high temperatures often being closely succeeded by cold weather. The rainfall in the third quarter is considerable; the first and second quarters are the driest.

Vital Statistics.—The marriage-rate in the Netherlands, for the ten years ending 1887, was 14·3; the birth-rate, 35·0; and the death-rate, 21·7 per 1000. The death-rate has been steadily falling during the past thirty years. In the period from 1853–58—years free from epidemic sickness—the average death-rate was 25·8, while it is now about 21 per 1000.

Pathology.—*Malaria.*—Holland is still the most malarious region of Northern Europe; although, from the progress of drainage and cultivation, improvements in the water-supply and in the dwellings of the middle and lower classes, and the general advance in social wellbeing, the health of the population has improved immensely during the present century.

The deaths from intermittent and pernicious fevers per 10,000 inhabitants, in the ten years 1879–88, were as follows:—

	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.
Intermittent Fever,	0·7	0·7	0·6	0·5	0·4	0·4	0·4	0·4	0·3	0·2
Pernicious Fever,	0·7	0·6	0·6	0·5	0·5	0·3	0·3	0·3	0·3	0·2
Total,	1·4	1·3	1·2	1·0	0·9	0·7	0·7	0·7	0·6	0·4

In addition to these distinctly paroxysmal fevers, we meet in

the returns of deaths with a continued fever, distinct from typhus and typhoid, which is probably mainly of malarial origin. This view of the character of this continued fever is based upon two facts—(1) that it is most prevalent, as a rule, in malarious localities; (2) that it has been diminishing in frequency *pari passu* with the decrease of intermittent fever, which seems to show that the same causes underlie both,—the sanitary measures which have effected a decrease in the one having produced a corresponding decrease in the other.

The following is the death-rate per 10,000 of the population from this form of continued fever for the ten years 1879–88:—

1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.
2·6	2·7	2·7	2·1	2·1	2·1	1·8	1·7	1·4	1·2

Combining these various forms of malarial fever, the deaths in 1888 gave a ratio of 1·6 per 10,000, or 160 per million of the population.

The subjoined tables give the death-rate per 10,000 living from intermittent and pernicious fevers in the several provinces, arranged in a descending scale as regards frequency, and also the death-rate from continued fever. The ratios are for the year 1887:—

Provinces.	Intermittent and Pernicious Fevers. Deaths per 10,000 Inhabitants.	Continued Fevers. Deaths per 10,000 Inhabitants.
Zeeland,	2·06	2·82
Friesland,	0·98	1·50
Gröningen,	0·92	1·18
North Holland,	0·83	1·60
South Holland,	0·57	1·71
Utrecht,	0·38	1·31
Overyssel,	0·27	1·09
Gelderland,	0·20	1·15
Drenthe,	0·15	1·02
North Brabant,	0·12	0·98
Limburg,	0·00	0·28

Zeeland is the province which takes the first place as regards the prevalence of paroxysmal and continued fevers. This province, aptly named "Sea-land," consists of the low-lying islands of Walcheren, North Beveland, South Beveland, and Shouwen, at the mouth of the Scheldt, and of the contiguous districts on the mainland. Much of the land has been reclaimed from the sea, and, being in many places below the sea-level, it is protected from its inroads by sand dunes and artificial dykes. The country is studded with polders, and intersected with ditches and canals. The soil is clayey, or an admixture of clay and sand.

The coast districts of Friesland and Gröningen, which, next to Zeeland, are the most malarious parts of Holland, abound in lakes and ponds, and are covered with a network of canals. The same conditions prevail in those districts of North and South Holland where malaria is intense.

Limburg and North Brabant, where malarial fevers are rare, are by no means destitute of marshy and water-logged localities; but, taking these provinces as a whole, they are much less marshy than the malarious provinces mentioned above.

Drenthe, Overyssel, Gelderland, and Utrecht, all of which are comparatively free from malaria, are more elevated and undulating, with a lighter and more porous soil, and they are generally non-marshy.

In what way the marshy soils favour the development of malaria is by no means clear; but that they do so in Holland cannot admit of doubt. A correspondent, writing from the Hague, says, "The common cause of malarial fevers is the summer drought drying up places commonly covered with water, and the ditches that are seen everywhere for the drainage of our agricultural land, and which in the neighbourhood of houses become the receptacles of all kinds of impurities."

The nature of the causes of the disease may be inferred from the measures that have been found to improve the health of the country. Let us take as an example the town of Middleburg, the capital of Zeeland, situated in Walcheren. Here a steady diminution in the fever mortality has been going on throughout this century. Dr. de Man has constructed a table from the death registers of the municipality, showing the number of deaths from various diseases for the ninety years 1792–1881. I extract the figures relating to intermittent fevers during that period:—

Decennial Periods.	Deaths from Intermittent Fevers.
1792–1801,	305
1802–1811,	534
1812–1821,	404
1822–1831,	304
1832–1841,	230
1842–1851,	211
1852–1861,	168
1862–1871,	88
1872–1881,	62

In this table the population (at present actually 16,000) has been reduced to a constant mean of 10,000. There were only 7 deaths from endemic fevers in each of the years 1879 and 1881.

This great improvement is ascribed by de Man to the means taken to prevent the admixture of sea water with the fresh water of the canals, and the alternate submersion and uncovering of the soil by the flux and reflux of the tide, and to the better drainage of the soil, the prevention of the impurities of the latrines passing into the canals, the better construction of houses, the paving of streets, and, finally, to the improved method of treating these fevers.[1]

[1] *Annales d'hygiène pub.*, May 1883.

Coming now to the seasonal distribution of malarial disease in the Netherlands, we remark that the malarious influence is sufficiently pronounced in Zeeland to affect the monthly distribution of the total mortality in that province. This will be seen by comparing the monthly percentage of the total deaths occurring in the non-malarious province of Overyssel with that of Zeeland during the years 1875–80 :—

MONTHLY PERCENTAGE OF DEATHS FROM ALL CAUSES IN OVERYSSEL AND ZEELAND.

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Overyssel,	9·51	8·76	9·71	8·95	8·78	8·27	7·49	7·78	6·67	7·29	7·63	9·15
Zeeland,	8·41	8·28	9·27	8·59	8·30	7·47	7·44	9·98	9·12	7·61	7·11	8·27

Hence the quarterly distribution of the deaths in the two provinces is as follows :—

	First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.
Overyssel, .	27·98	26·00	21·94	24·07
Zeeland, .	25·96	24·86	26·54	22·99

Whereas in Overyssel, as in the kingdom taken as a whole, the first is the most unhealthy quarter, in Zeeland the months of August, September, and October are those in which the maximum mortality occurs. This disturbance of the seasonal death-rate in Zeeland is evidence of the dominating influence of malaria in the pathology of this province.

It is rather remarkable that the deaths from intermittent and pernicious fevers also show a different distribution in Zeeland from that in the non-malarious provinces. This will be seen by comparing the monthly percentage of the deaths from these diseases in Zeeland and North Brabant for the years 1875–80. The total number of deaths from intermittent and pernicious fevers in North Brabant during that period was 198, and in Zeeland 327. The monthly percentage in the two provinces was as under :—

MONTHLY PERCENTAGE OF DEATHS FROM INTERMITTENT AND PERNICIOUS FEVERS DURING THE PERIOD 1875–80 IN NORTH BRABANT AND ZEELAND.

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
North Brabant,	11·11	10·10	7·57	7·57	9·09	7·07	10·60	8·59	5·05	7·57	4·04	11·62
Zeeland, . .	6·72	5·81	7·64	10·09	8·87	9·78	4·89	8·56	11·01	11·62	5·19	9·78

The months of September and October, which are among the healthiest in North Brabant, are those in which malaria is most fatal in Zeeland. Perhaps the explanation is that in North Brabant malarial fever comparatively seldom cuts off the patient at once, the sufferer succumbing during the succeeding winter; while in Zeeland the infection has sufficient intensity to induce a fatal issue during the first attacks.

The months of March and April, and again of August, September, and October, are those during which pernicious attacks are most frequently fatal. In Overyssel and North Brabant these cases are particularly common in the cold months, and also in May.

Females, in all the provinces, are more liable to malaria than males; and this holds good for continued fevers. The special liability of the female sex is particularly marked in the healthy province of Overyssel, where, out of 91 deaths from intermittent and pernicious fevers, 57 were of females and 34 of males.

Holland has suffered frequently from malarial epidemies. Sylvius de le Boë describes a severe epidemy which raged in Leyden and the surrounding country in 1669. He ascribed the disease to the great heat and stillness of the atmosphere, and to the impure exhalations from the soil and marshy grounds caused by the intense solar heat. This epidemy was marked by bilious vomiting, petechial spots, epistaxis, and discharge of blood from the rectal veins. The fever was of a quotidian or tertian type. Some doubts, however, may be entertained as to the precise nature of this fever. Several epidemies occurred during the eighteenth century, but I have no precise information as to the character or the conditions in which they arose.

Pringle, who has narrated the sufferings of the troops in Holland in 1748, states his opinion that the heat and moisture of the air were the chief external causes of these fevers.[1] He notices that, towards the end of July, when the days were sultry and the nights cool and foggy, several of the men (of those regiments which lay nearest the inundation) were seized suddenly with fever.

Mr. Jough describes the village of Dintha as lying low, and as being surrounded by ditches and thick plantations. He says that the district was covered by a fog from sunset to sunrise, which had the offensive smell of a foul ditch newly drained. This offensive fog was evidently suspected to be a cause of fever among the troops.

In 1794, as already stated, the troops suffered greatly in the moist sandy plains of Rozendaal and Oosterhaut. To what extent the disease was prevalent in the general community in these years I know not.

Haeser states that in 1807 to 1809 the Russian, Prussian, and Polish armies in Holland were decimated by pernicious fevers.

The Walcheren Expedition of 1809 is one which exhibited in a manner, and to a degree seldom met with, at least in temperate regions, the dire influence of malaria under certain conditions. The leading points connected with this expedition, as narrated by Sir

[1] *Observations on the Diseases of the Army*, 7th ed., Lond. 1775, p. 184 et seq.

Gilbert Blane, are these :—The troops sailed from the Downs on the 28th July 1809, landed in Walcheren and North and South Beveland on the 31st July and the 1st August. Flushing was invested on the 1st August, and capitulated on the 15th of the same month. In the beginning of September the islands of North and South Beveland were evacuated, and that portion of the army which occupied them returned to England, leaving about 18,000 men to garrison Walcheren. More than one half of these died, or were sent back to England on account of sickness, in the course of the three following months, and the island was finally evacuted on the 23rd of December 1809. The admissions into hospital between the 21st August and the 18th of November amounted to 26,846, including relapses, and the whole number of sick, including a small number of wounded, conveyed from thence to England between the 21st August and the 16th December, amounted to 12,863; and many instances occurred, in the case of those who returned to England apparently in health, in whom the endemic disease of Zeeland appeared after the slight fatigue of a march. The disease did not show itself among the soldiers during the first month of their residence in Holland.

This year, so fatal to the British army, was not an unusually unhealthy one for the natives, but rather the reverse. They accounted for the comparative healthiness of the year by the uncommon quantity of rain that had fallen, the result of their observations being that sickly years were those in which there had been great droughts and heat in the latter end of summer and in the early part of autumn.

The following table, given by Blane, shows the progress of the epidemy from week to week. I have added the proportion per 1000 of sickness and deaths to the average weekly strength :—

Date of Return.	Strength.	Weekly Number of Sick.	Weekly Ratio of Sick per 1000.	Number of Deaths.	Weekly Ratio of Deaths per 1000.
10th September,	17,870	6,931	387·86	221	12·37
17th ,,	17,410	8,141	467·60	227	15·95
24th ,,	16,409	8,754	533·43	287	17·49
1st October,	16,156	9,127	564·93	254	15·72
8th ,,	15,276	8,969	587·13	217	14·20
16th ,,	wanting	wanting	—	—	—
23rd ,,	13,017	7,145	548·13	128	9·83
31st ,,	11,747	6,228	531·04	121	10·31
7th November,	wanting	—	—	—	—
14th ,,	8,868	3,799	428·38	40	4·51
21st ,,	7,926	1,226	154·66	36	4·66
29th ,,	6,261	1,158	185·95	30	4·79

From this it would appear that the disease was most prevalent in the last fortnight of September and during the month of October,

but still continuing, probably as relapses, in November. The fever, judging by the death-rate, attained its highest intensity in September, diminishing rapidly in virulence in October, and losing its fatal character in November.

In 1826 the malarial pandemy already referred to, which in Holland followed an overflow of the German Ocean, and occurred in a very warm season, was more or less general over the kingdom, but visited some localities, such as Gröningen, with special severity. Here 8000 out of a population of 30,000 were attacked, and 3000 died. It was observed to be more severe in places where the soil was an impermeable clay than where it was sandy. Indeed, it is said that from sandy localities, even when they had been subject to inundation, the disease was, so to speak, cut off, while surrounding clayey soils suffered. Dr. Nieuwenhuys gives the fever deaths in Amsterdam during this year at 2390, out of a population of 200,784, being 1 in every 84 inhabitants.[1]

Another epidemy of malaria occurred in 1834. That year was remarkable for its uncommonly mild winter, cool spring, and hot summer. In Amsterdam, Hoorn, Eukhuizen, and Alkmaar, which are or were marshy, the excess of deaths over births varied from one-fifth to one-tenth. In Rotterdam, Utrecht, 'SGravenhage, and Dordrecht, where the soil is solid or sandy, the births preponderated over the deaths.

It was in August that the intermittent fever began to assume a formidable aspect, and in October it reached its height. The disease was generally of an intermittent character at the commencement, often assuming during its progress a remittent or sub-continued type. There was a frequent tendency to bilious disorder; delirium in adults and convulsions in children were common.

Intermittent fever was again prevalent in the Netherlands in 1846, after a hot summer. I am not aware to what extent the pandemies of 1855–60 and of 1866–72 affected the Netherlands.

Typhoid Fever is less prevalent in the Netherlands than in England. The mean annual number of deaths from typhoid and typhus, for the five years 1883–87, was 667·6, and the mean population 4,308,425, which gives an average death-rate of 155 per million; while the death-rate in England for the same years for typhoid alone was 199 per million, or for typhus and typhoid together 214 per million living. The death-rate from typhoid fever is, as in England, a diminishing one, and varies considerably

[1] *Trans. Prov. Med. and Surg. Assoc.*, vol. iv., London 1836; and *Med. Chir. Rev.*, July 1836.

in different years. It will be seen from the subjoined table that in 1885 the disease was considerably less frequent than in the preceding and following years,—which was also notably the case in England. Indeed, the enteric mortality in Holland and in England during these years rises and falls simultaneously. This shows that the prevalence of typhoid fever is determined by some general cause or causes, climatic or other, affecting extensive regions,—a point of considerable importance as bearing upon its etiology.

Local conditions also affect its prevalence, as is proved by the fact that the different provinces suffer very unequally:—

Deaths from Typhus and Febris Typhoidea.[1]

	1883.	1884.	1885.	1886.	1887.	On 1000 deaths (except still-born and unknown causes), and on 1000 inhabitants. 1887.	
N. Brabant, . .	44	57	34	59	49	4·98	0·098
Gelderland, . .	78	75	70	77	55	6·37	0·110
S. Holland, . .	117	147	99	122	109	5·71	0·120
N. Holland, . .	224	157	129	137	104	6·73	0·132
Zeeland, ...	11	19	14	20	25	7·46	0·126
Utrecht, ...	48	35	38	30	24	5·88	0·113
Friesland, . . .	69	74	61	57	55	10·02	0·164
Overyssel, . . .	64	80	53	70	64	11·14	0·220
Gröningen, . . .	50	44	40	67	49	11·22	0·181
Drenthe, . . .	37	46	15	22	21	10·64	0·165
Limburg, . . .	23	30	18	9	13	2·73	0·051
The Netherlands, .	765	764	571	670	568	6·86	0·129

We cannot observe here any law of mutual exclusion or otherwise between the prevalence of malaria and typhoid. Zeeland, the most malarious province, has a typhoid death-rate close upon the average. Friesland, which takes the second place in respect to malaria, has a typhoid death-rate considerably above the mean. Overyssel, which is non-malarious, pays, it is true, the heaviest tribute to typhoid; but, on the other hand, Limburg, which did not return a single death from malaria in 1887, also suffers least from typhoid fever.

The total deaths from typhus and typhoid in the three great towns of Amsterdam, Rotterdam, and the Hague in the four years 1885–88 were 352, which were thus distributed by quarters:—

First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.
91	66	75	120

[1] *Report of the Medical Commissioners for* 1887, p. 246.

Diphtheria, in the five years ending 1887,[1] caused 161 deaths per million living in the Netherlands, and for the same period the ratio was 162 in England, so that we may say that the disease is equally prevalent in the two countries,—a proof, if proof were required, that diphtheria is in no way related to malaria. In 1887 the provinces of North Holland and Utrecht were most affected, and Drenthe and Limburg least so; but the variation in the mortality in the same province in different years is very marked. Thus, North Brabant had only 11 deaths from diphtheria in 1883, while in 1886 the deaths numbered 147. The epidemic causes of diphtheria are local; this is proved by the fact that in 1883 North Brabant was almost free from diphtheria, while North Holland suffered with unusual severity; and the case was again reversed in 1886, when North Holland suffered little and North Brabant much. Out of 590 cases occurring during the four years 1885–88 in Amsterdam and the Hague, the distribution by quarter was as follows:—

First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.
171	137	102	180

Croup caused, for the five years ending 1887, a death-rate of 0·303 per 1000 living, and 16·06 per 1000 of the total mortality. The disease is most prevalent in the provinces of Overyssel and Friesland, and is rare in Limburg and Gröningen.

Diarrhœa.—The mean death-rate from diarrhœa, exclusive of dysentery, in the ten years 1879–88, was 461·0 per million for the whole kingdom; for the five years 1881–85, the ratio in England was 652·4 per million; diarrhœa is thus less common in the Netherlands than in England. The distribution of diarrhœal deaths per 1000 in the several provinces in 1887 was as follows:—

North Brabant,	0·32	Friesland,	0·14
Gelderland,	0·16	Overyssel,	0·24
South Holland,	0·79	Gröningen,	0·08
North Holland,	0·19	Drenthe,	0·20
Zeeland,	1·24	Limburg,	0·02
Utrecht,	0·53		

It will be seen that diarrhœa is specially fatal in Zeeland.

Dysentery.—The death-rate from dysentery from 1879 to 1888 averaged 0·1 per 10,000 inhabitants, or 10 per million. For 1887 the ratio was as low as 0·06 per 10,000, or 6 per million. In England, during the ten years ending 1880, the ratio was 28 per million. It would thus appear that dysentery is actually more fatal

[1] *Verslag aan den Koning van de Bevindingen en Handelingen van het Geneeskundig Staatstoezicht in het jaar* 1887, Hague 1888.

in England than in malarious Holland. It may be noted that in 1887 none of the 26 fatal cases of dysentery occurred in Zeeland. Last century dysentery was epidemic in the Netherlands in 1719 and 1779 (Hirsch). During this century the disease, in a severe epidemic form, has seldom been noticed.

Cholera Nostras gave rise to 0·034 and 0·019 deaths per 1000 in 1886 and 1887 respectively.

The Netherlands suffered from all the cholera epidemies which visited the neighbouring regions.

Typhus.—We have no data for estimating the prevalence of typhus in the Netherlands, as the cases are returned along with typhoid. So far as one can judge, it is extremely rare.

Smallpox, during the five years ending 1887, gave rise to an average of 39·7 deaths per million; in England, during the same period, the mortality was 49·8 per million.

Scarlatina gave an average death-rate of 177 per million, and *measles* of 346 per million, for the five years ending 1887, which ratios are lower than in England.

Whooping-Cough, in the four years 1885–88, caused a death-rate of 0·32 per 1000 in Amsterdam, Rotterdam, and the Hague; and the mortality for the whole country for the ten years 1879–88 was 0·34. The mortality in England for whooping-cough averages about 0·46 per 1000.

Acute Diseases of the Respiratory Organs, during the ten years ending 1888, gave rise to a death-rate of 2470 per million.

Chronic Respiratory Diseases caused a mortality of 1272 per million.[1]

Phthisis.—The death-rate per 1000 from phthisis, for the period 1869–74, in the Netherlands was 2·46 per 1000, or 2460 per million, and during the ten years 1879–88 to a ratio of 1977 per million. The ratio for the several provinces during the earlier period was as follows:—

North Brabant,	2·46	Friesland,	2·51
Gelderland,	2·49	Overyssel,	3·27
South Holland,	2·28	Gröningen,	2·38
North Holland,	2·38	Drenthe,	3·09
Zeeland,	1·87	Limburg,	2·33
Utrecht,	2·62		

It is to be remarked, in connection with the theory that malaria is antagonistic to phthisis, that Zeeland, the most malarious province, is that where phthisis is least fatal, while Overyssel and Drenthe, which are little influenced by malaria, have a high phthisical mortality. Yet, on the other hand, it will be noted that as a whole

[1] Jaarcijfers over 1888 en vorige jaren.

phthisis is more fatal in Holland than in England, notwithstanding the freedom of the latter from malaria.[1] Malaria may have some antagonistic influence; but if so, it is not a dominating one.

Scrofulosis (Klierziekte) and *Rachitis* are combined in the returns. Together they gave rise to a death-rate of 340 per million for the ten years 1879–88.

Syphilis gives a ten years' average death-rate of 12 per million, which contrasts favourably with that of England, where, in 1884, it stood at 84 per million.

Rheumatism.—Rheumatism is combined with heart disease in such a way that it is impossible from the returns to ascertain the fatality of rheumatic affections.

The death-rate from *Cancer* (1884–88) was in the ratio of 656 per million.

[1] Droeze, *De Sterfte van phthisis in Nederland*, Leid. 1879, quoted by Hirsch.

CHAPTER XIII.

BELGIUM.

Geography.—Belgium is bounded on the north by Holland and the North Sea, on the east by Germany, and on the south and west by France. It has an area of 11,373 square miles, and its population in 1887 was 5,974,743. The sea-coast of West Flanders is continuous with Holland, and presents the same physical features as the latter, requiring in parts to be protected by dykes. The Campine, in the north-east of the province of Antwerp and the adjoining districts of Limburg, is a tract of marsh and heath. Luxemburg, Namur, part of Hainault, and Liége are more or less elevated and diversified, rising in the Ardennes to 2000 feet above the sea-level.

The principal rivers are the Scheldt and Maas, and the tributaries of the former, which, along with the numerous canals, intersect the country in all directions.

Climatology and Vital Statistics.—The mean temperature C. of Brussels is as follows:—

January.	April.	July.	October.	Year.
2·0	9·0	18·0	10·4	9·9

The annual rainfall of Brussels is 727 mm.; along the sea-coast it amounts to 900 mm., and to 1000 on the Ardennes. The coast country is cool, humid, and equable; in the high lands the summers are hot and the winters warm.

The marriage-rate in Belgium, for the ten years ending 1887, was 13·7; the birth-rate, 30·6; and the death-rate, 20·9 per 1000.

The seasonal distribution of deaths per cent. is as follows:—

Winter.	Spring.	Summer.	Autumn.
28·34	27·85	21·76	22·05

Pathology.—*Malaria* is at the present time almost confined to the provinces of West Flanders, East Flanders, Limburg, and Antwerp,—the cases in the last-mentioned province being few. The other provinces are healthy. In 1888 three deaths from ague are

recorded as having occurred in Brussels, but it by no means follows that they were contracted there. Ghent suffers very considerably from intermittent fevers. In Liége, malaria is unknown.

Meynne observes that in Belgium malarial fever is found to prevail most, and with greatest intensity, in warm summers.[1]

Lombard mentions some local epidemies of malaria in Belgium. One of these occurred between 1839 and 1841, in the Commune of Lonzé in Namur, as the result of cleaning out the mud from the *bassin d'Arlon;* twenty-five persons died. The epidemy subsided when the works were finished.

Another epidemy developed from a similar cause in the Commune of Soye in 1836 and 1837. The moats of Ypres have also given rise to occasional epidemies of fever. Typhoid fever is most fatal in the non-malarious districts of Belgium.

Enteric Fever.—Raseri gives the typhus and typhoid death-rate of the principal towns (1881–84) at 469 per million; and of Belgium, as a whole, at 617 per million. In Brussels the death-rate from typhoid fever from 1855 to 1888 was only 211 per million. The maximum mortality from this disease falls on the three months of September, October, and November.

Typhus was epidemic in Belgium in 1840–44, and again, and still more severely, in 1846–48; and in both instances, according to Hirsch, it coincided with interruption of commerce and failure of the crops. A few cases of *Relapsing Fever* were observed in Belgium in 1867.

Diphtheria and *Croup* are prevalent in Belgium, especially in the country districts. Brussels, however, is not so much affected, the mortality from 1885 to 1888 having been at the rate of 164 per million.

Diarrhœal Diseases, including diarrhœa, dysentery, and enteritis, according to the figures given by Lombard, are less fatal in Belgium than in England—the death-rate being 8·2 per 10,000 inhabitants. In Brussels the mortality from these diseases, from 1885 to 1888, averaged 25·42 per 10,000. The three months, July, August, and September, are those in which the disease is most fatal.

Asiatic Cholera.—It was observed that the low humid lands did not suffer from the epidemies of this disease. Lombard remarks that many localities where polders exist, and which are low and humid, escaped, as did also that part of Flanders where one meets much water.

Miliary Fever.—Belgium is one of the countries in which the sweating sickness has been observed, but here only to a small

[1] Meynne, *Topog. méd. de la Belgique,* Brux. 1865.

extent. A mild epidemy occurred in 1838; it then appeared along with cholera in 1849, and again in the neighbourhood of Mons in 1850. It was last observed in the province of Luxemburg in 1866.

The eruptive fevers, *Smallpox, Measles,* and *Scarlet Fever,* differ little in frequency or character from those observed in neighbouring countries.

Phthisis is more fatal in Belgium than in most parts of Europe. The death-rate from this disease (1851–55) was given by Meynne at 3500 per million, and (1856–59) by Bertillon at 4100 per million. In Brussels, from 1864 to 1878, the mortality was 5600 per million. It is least prevalent in Luxemburg, Namur, Liége, and Hainault, where malaria is least felt; and it is most common in Limburg, East and West Flanders, and Antwerp,—provinces which are in varying degrees subject to the malarious influence. Brabant and Hainault occupy an intermediate position on the list, while Namur, Liége, and Luxemburg suffer least.

Bronchitis is less frequent in Belgium than in England; *Pneumonia* is about equally common in the two countries. During the ten years 1871–80, the deaths from pneumonia in Brussels were in the ratio of 2·2 per 1000 living. In Brussels, bronchitis attains its maximum in December, January, and February, and pneumonia in January, February, and March.[1]

Whooping-Cough appears in outbreaks of varying severity at irregular intervals; but the average mortality from the disease does not appear to differ in Belgium from that in neighbouring countries.

Cancer gave rise to a death-rate in Brussels of 390 per million from 1864 to 1873, and of 420 per million from 1874 to 1878,—a proportion considerably under that of many large towns in Europe. It is most fatal in Brabant and East Flanders, and much less so in Luxemburg and Limburg.

Acute Rheumatism caused, from 1862 to 1875, a proportion of 3 per 1000 deaths. In England, rheumatic fever and rheumatism of the heart caused 5·1 per 1000 deaths from all causes. Chronic rheumatic affections are said to be very common, especially in the country districts.

Diabetes caused a proportion of 0·60 per 1000 of the total deaths in Brussels from 1864 to 1880.

Scrofula is widely diffused in West Flanders, Limburg, Antwerp, and Brabant. It is less frequent in Hainault, Liége, Luxemburg, and Namur.

Goitre is met with only in a few localities in Belgium, and the cases are not numerous. *Cretinism* is very rare.

[1] Janssen, *Annuaire Demograph. Ville de Bruxelles,* Brux. 1888.

CHAPTER XIV.

FRANCE.

GEOGRAPHY.—France stretches across the west of Europe from Belgium on the north to the Pyrenees and the Mediterranean on the south. It is divided by the Alps from Italy on the south-east and by the lines of the Jura and Vosges mountains from Switzerland and Germany. On the north-west and west it is bounded by the English Channel and the Atlantic. France has an area of about 201,600 square miles, and is divided into thirty-six departments, with a population of 38,218,903.

The chief rivers running into the English Channel are the Somme and the Seine; and into the Atlantic flow the Loire and Garonne. The only river of importance running into the Mediterranean is the Rhône. These and their tributaries form the great river systems of France. Besides these, the Moselle, Meuse (Maas), and the Scheldt rise in the north and north-west of France.

Considerable tracts of marshy land are still met with in some departments of France. Lombard gives the area, in hectares, of marsh as follows:—Charente-Inférieure, 30,531; Loire-Inférieure, 19,498; Bouches-du-Rhône, 15,270; Landes, 13,742; Gard, 11,325; Gironde, 10,584; Somme, 8930; Manche, 7645; Oise, 6152; Pas-de-Calais, 6071; Aisne, 5800; Aude, 5751; Isère, 5281; Hérault, 4251; Vendée, 4151; Marne, 3834; Morbihan, 3591; Deux-Sêvres, 2691. Smaller areas are met with in other departments. The greater part of the country is fertile, well cultivated, and free from malaria; but in some of the districts, as we shall presently see, endemic fevers are frequent and severe.

The mean annual temperature C. from the north to the south is as follows:—

North Coast and Interior.		Middle Zone.		South Coast and Interior.	
Lille,	9·08	La Rochelle,	11·8	Bayonne,	14·2
Havre,	10·2	Bordeaux,	12·6	Toulouse,	12·65
Brest,	11·3	Moulins,	10·05	Montpellier,	13·6[1]
Nantes,	11·5	Limoges,	10·5	Marseilles,	14·0
Mézières,	8·5	Dijon,	9·15	Nice,	14·0
Paris,	9·9	Lyons,	9·6		
Nancy,	8·7	Besançon,	9·3		
Orléans,	10·1	Valence,	11·7		

[1] Arnould, *Dict. ency. scien. méd.*, art. "Climat.," Paris.

It will be seen that the mean annual temperature of Nice in the south is 5·5 degrees higher than that of Mézières in the north.

Martins divides the climates of France into the following:—

(*a*) The "Vosgien," on the north-east, from Mézières south to Auxerre, and stretching to the east frontier. The mean temperature is 9° to 10°; the difference between summer and winter is 18°; the rainfall is 670 mm. The summer is the rainy season in this region.

(*b*) The "Séquanien," or north-west region, extends from Mézières and Auxerre west to the Channel and Atlantic, and south to the river Loire. The mean temperature of this region is 10°·9; the difference between summer and winter is 13°·6; the rainfall is 548 mm.

(*c*) The "Girondin," or south-west climate, is that of the country lying between the Loire and the Pyrenees. It has a mean annual temperature of 12°·7; the difference between winter and summer being 15°·7; the rainfall is 586 mm. The autumn and winter are the most rainy seasons.

(*d*) The "Rhodanien," or south-east climate, comprises the valley of the Saône and Rhône. The mean annual temperature is 11°·0; with a difference between winter and summer of 18°·8. The spring and autumn are rainy, the summer and winter drier; the rainfall is 946 mm.

(*e*) The "Mediterranean" climate is that of the region included in the triangle formed by the towns of Montpellier, Marseilles, and Viviers. The mean temperature of this region is 14°·8; the difference between summer and winter being 16°·1; the rainfall is 654 mm. The summer here is very dry; this region is exposed to the destructive north-west wind called the *Mistral.*

We shall add the monthly temperature C. and rainfall in mm. of a few representative localities:—

		Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Bordeaux,	T.	7·1	8·8	8·5	14·4	17·9	20·6	22·6	20·0	19·0	14·3	10·4	6·8
	R.	93·4	63·1	58·2	53·0	68·8	66·9	58·4	50·6	53·6	101·0	72·8	63·0
Perpignan,	T.	7·6	9·7	9·9	14·3	18·0	22·3	23·1	23·0	20·4	14·7	11·2	6·8
	R.	44·4	40·5	40·7	45·6	65·6	35·6	20·5	31·7	51·8	50·7	54·3	47·8
Toulon, .	T.	7·3	9·8	9·5	13·0	17·0	20·6	22·9	21·9	19·9	15·0	10·4	8·1
	R.	62·7	78·2	60·1	51·5	49·2	16·5	5·8	21·6	87·5	187·5	110·5	70·7
Montpellier,	T.	4·8	8·4	9·0	13·2	18·0	21·0	23·4	21·4	18·6	13·2	7·9	5·7
	R.	78·8	90·6	71·14	39·4	89·0	44·3	21·9	40·3	93·3	142·4	93·0	62·5
Paris, .	T.	2·0	4·5	6·5	10·1	14·2	17·2	18·9	18·5	15·7	11·3	6·5	3·7
	R.	35·8	23·3	41·9	32·5	51·2	42·3	48·9	38·9	52·5	51·5	40·7	32·4
Lyons, .	T.	3·6	6·4	6·7	12·7	15·4	20·0	21·3	19·7	18·2	11·7	6·5	2·1
	R.	34·0	29·4	52·0	43·8	76·0	79·7	50·6	64·3	66·2	99·2	52·7	38·4

VITAL STATISTICS.—The marriage-rate in France for the ten years ending 1887 was 14·9; the birth-rate, 24·5; and the death-

rate, 22·2, or 1 per 1000 higher than that of England and Wales. The extraordinarily low birth-rate may well give rise to reflection.

The following was the monthly mortality in France for the period 1855–61:—

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1090	1141	1094	1026	936	855	876	1016	1073	983	966	950 = 12,000

The winter is thus the season of the highest mortality in France; but along the coast of the Mediterranean and in the marshy districts the mortality is autumnal.

Pathology.—The distribution of malaria in France is chiefly maritime or fluviatile, and has an evident relation either to salt or fresh water marshes, properly so called, or to simple water-logging of the soil. Where it appears in the interior, and not along the course or the banks of any great river, it is always in marshy plains or damp valleys. Its presence is thus associated with stagnant water in the soil rather than with climate; but its intensity, as measured by its fatality, increases as the temperature rises. It is thus more severe, other things being equal, in the south than in the north—along the Mediterranean than along the Channel. The deaths from intermittent fever for the whole of France formed, according to Lombard, 6·30 per 1000 of the total deaths in the years 1855–57.

The following table will serve to indicate in a rough way the incidence of malaria in France generally:—

Distribution of Admissions from Malarial Fevers in each Corps d'Armée for the Quinquennial Period 1875–79.[1]

Algéria	165	Amiens, Le Mans, Bourges	5
Marseilles, Montpellier	22	Orleans	6·8
Government of Paris, Bordeaux	17	Lyons	6·4
Nantes	14	Rouen, Châlons	5·4
Clermont	12	Lille	4·9
Rennes	10	Besançon	4·0
Limoges	9		
Tours	8		

If we examine the distribution of malaria in detail, beginning with the river basins, we find that the basin of the Somme itself, and the country to the north and south of that river, are generally healthy. Dr. Arnould, of Lille, in a private letter which I have seen, says that malarial fever and dysentery are almost unknown in Lille, but that fever exists in Dunkirk and St. Omer in the districts of Waterinques and Watergands—veritable polders, but they are neither very common nor very grave.

[1] Marvand, *Annales d'hygiène pub.*, Nov. 1883.

The basin of the Seine is more distinctly malarious. The mouth of the river, on its right bank, says M. Gilbert, has been ravaged at different epochs by marsh fever. During the past twenty years important drainage works have considerably reduced the number of cases of paludism.

The comparative prevalence of malaria in Paris, as compared to other parts of France, is shown by the table given above. The figures represent the Government of Paris as being as severely affected as Bordeaux, which is a decidedly malarious locality. This is scarcely what we might have expected from the latitude and surroundings of the capital. According to this table, Paris occupies the third place in the list of malarious stations, following Marseilles and Montpellier, and standing before Nantes and Clermont. The comparative prevalence of malarious affections in Paris may arise from temporary conditions connected with the building of the new fortifications.

We know that disturbance of the soil in Paris is by no means free from danger. An epidemy of intermittent fever broke out here in the quarters of the Temple, La Villette, and Pantin, in 1811, while the canal of St. Martin was being dug. In 1840 an epidemy of the same nature occurred while the excavations for the former forts were being made.[1]

The following table, for which I am indebted to a correspondent, gives the deaths from malarial fever and malarial cachexia in Paris from 1880 to 1888:—

Years.	Deaths from Malarious Diseases, and Ratio per Million of Population.				
	Number of Deaths.	Intermittent Fever. Ratio per Million.	Number of Deaths.	Malarial Cachexia. Ratio per Million.	Total.
1880, . . .	15	5·57	8	2·97	8·54
1881, . . .	14	5·20	4	1·49	6·68
1882, . . .	10	3·71	6	2·22	5·94
1883, . . .	8	2·97	6	2·22	5·20
1884, . . .	9	3·34	11	4·08	7·42
1885, . . .	11	4·08	1	0·37	4·45
1886, . . .	5	1·86	3	1·11	2·97
1887, . . .	11	4·08	5	1·86	5·94
1888, . . .	5	1·86	3	1·11	2·97
Mean of Nine Years,	88	3·63	47	1·91	5·56

It will be seen that the proportion of deaths per million of the population for the nine years included in the table is, on the average,

[1] Colin, *Fièvres intermittentes*, Paris 1870, p. 16.

3·63 per million for malarial fever, and 1·91 for malarial cachexia, or a mean average death-rate for malarious diseases of 5·56 per million.

Under what conditions of soil are these fevers developed in Paris and its neighbourhood? This question is partly at least answered by Dr. Rives in the instance of the quarter of Maison-Blanche. He informs us that the insalubrity of this quarter arises essentially from its situation on the banks of the Bièvre, and is manifested by the frequency of paludal affections. The soil is a permeable calcareous alluvium resting on clay. The fever is mostly confined to the bottom of the valley, but reaches altitudes of 25 mêtres in those houses which are not shut off from the valley. Dr. Rives observed 131 cases of malarial fever in this quarter from 1878 to 1886, of which 96 were of the normal intermittent type, 32 abnormal, and 3 pernicious, of which last-mentioned form 1 died.[1]

Intermittent fever was epidemic in the department of Aisne, with its 5800 hectares of marsh, in 1866, and again in 1868 (Rey).

Proceeding southwards, we come to the valley of the Loire, which forms an extensive habitat of endemic fevers. They are met with in varying degrees of frequency and severity from the mouth of the river up to Tours. From the table of deaths in the French army, intermittent fever would appear to be more common at Nantes near the mouth of this river than at Tours in the interior. This can readily be understood, from the fact that the department of Loire-Inférieure ranks second in respect to the area of marsh land. Beyond Tours, in the department of Loiret, there is the Sologne, a district of evil repute for malarious diseases. According to Armand, the marshes of La Sologne, covering a fourth of the soil, are artificially formed by barriers, and stocked with fish. At the end of three years they are emptied by raising the sluice, and the fish are collected. The following year they sow the soil, and when the harvest is gathered they recommence as before. In 1793 the Convention decreed the suppression of these artificial marshes (Étangs). The measure was carried into effect; but the Convention soon discovered that, under the pretext of ameliorating the hygienic condition of the inhabitants, they had simply condemned them to starvation. The decree was recalled.[2] Of late years much has been done to improve the health of this district.

In the department of Indre, between Châteauroux and Leblanc, is the feverish and swampy plain of La Brenne, situated in the valley of the Indre, a tributary of the Loire. The department of

[1] Rives, *Étude des Causes d'insalubrité speciales au Quartier de la Maison-Blanche*, Paris 1887.

[2] Armand, *Med. et Hyg. des Pays Chauds*, p. 453, Paris.

the Indre, where this focus of malaria exists, is not given by Lombard as one containing marsh. Bertrand gives the following account of this region :—"Brenne," he says, "comprises the three cantons of Blanc, Tournon-Saint-Martin, and Mézières, and a part of that of Saint Gaultier. The soil is clayey and destitute of vegetable mould. The water, not being able to penetrate the *tuff*, settles in large pools. Everywhere there are large uncultivated plains, named *Brandes*, covered by pools and marshes. Intermittent fevers ravage the country, and often exhibit the gravest forms."

Angers and La Fléche, to the north of the Loire, the latter occupying the valley of the river Loire, are also feverish. In the eastern part of the Loire basin, between the Upper Loire and the Cher, is the department of Cher, a calcareous plateau liable to inundation from the numerous streams. It is subject to malarial fevers, but of a mild type, generally quotidian, which are met with chiefly in the autumn and spring.

The valley of the Garonne, from its mouth through the departments of Gironde and of Lot et Garonne, is under the malarious influence, which, however, does not reach, or only in a mild degree, the upper course of the river. As an example of the causal connection between a wet soil and the production of malaria, Hirsch quotes the following from Gentrac :—"The department of the Gironde is divided by the Garonne into two almost equal parts, a north-eastern, with higher elevation and a thoroughly dry soil, and a damp south-western division, the southern extension of which is the plain rising somewhat towards Landes, with the highly malarious Bordeaux at the northern apex of the triangle. Of 484 patients admitted for malarial fever into the Bordeaux hospital during four years, 105 came from the arrondissements on the eastern bank of the Gironde, and 379 from those on the western; but inasmuch as the population of the first division was 254,150, and that of the second only 179,429, the ratio of sickness in the whole population was in the former case 1 in 2420, and in the latter 1 in 473.

We come now to the Rhône valley, where there exist many foci of malaria. The delta of the Rhône, comprised in the department Bouches-du-Rhône, contains, according to the estimate given above, 15,270 hectares of marsh lands. This region is extremely unhealthy, especially at Aigues-Mortes, Martigues, Marignane, and the Étang de Berre. The Camargue is, in fact, probably the most unhealthy region of France. In the department of Vaucluse the Palus de Monteux is also noted as specially malarious. From this point up to Lyons, although less intense than in the delta, malaria is still met with along the whole basin of the river. Lyons itself,

situated at the junction of the Saône and the Rhône, is certainly not free from the disease. We have the authority of Marmy and Quesnoy for stating that malarial diseases are common in the more humid suburbs of the town, where, towards the end of summer and in autumn, they sometimes assume a pernicious character. The army returns do not, however, give an unfavourable view of the salubrity of Lyons. In 1872, 2·4 per cent. of the admissions into the civil hospitals were for malarial fever, and of these only four died.

To the north of Lyons are the marshy plains of Dombes and Bresse, between the Saône and the Ain, which are highly insalubrious.

Nepple has given an admirable description of the physical character of this region, its inhabitants, and diseases, which has lost none of its value by the changes which may have taken place in later times.

We interrupt for a little our general survey in order to take a glance in passing at the picture of Dombes as drawn by Nepple.[1]

He divides La Dombes into three zones: (*a*) the country of ponds (Étangs); (*b*) the region of slopes; (*c*) the plains. The region of Étangs covered, when he wrote (1835), two-thirds of the plateau of the Dombes, which occupies the centre of the department of Ain. The plateau is level, the soil an impermeable clay, which would have converted the whole region into a vast uninhabitable marsh, were it not that the inhabitants have drained off the water into the depressions, thus forming small lakes or ponds. These are stocked with fish, and after about two years the ponds are drained, the fish secured, and the bed of the lake ploughed and sown. Besides these ponds, there is to be met with an infinite number of small marshes, formed and maintained by the rains or by the overflow of the ponds. The banks of the shallower ponds, and the pits dug in preparing these reservoirs, also form marshes, in which myriads of insects, worms, toads, and frogs multiply. The smell from these marshes is extremely heavy and sickening in summer. The atmosphere of the Dombes is hot and humid during the day. The north-east wind from the mountains begins to blow at night, causing, after sunset, a sensation of cold, and condensing the vapours into an abundant dew. During autumn and winter, unless when there is frost, thick fogs envelope the country.

The Dombiste (*i.e.* the inhabitant of the Dombes) is recognised at the first glance by his pale complexion, his drawn-out, emaciated, or puffy features, his flabby muscles, his slow step, a certain indolence in all his movements, and his swollen belly. His intellectual

[1] Nepple, *Traité sur les fièvres remittentes et intermittentes*, Paris 1835.

faculties are limited. He is indifferent as to his condition, and wants moral energy. The strangers that come to assist in reaping the harvest often carry back with them the germ of interminable fever. The cattle also degenerate in the zone of Étangs; horses thrive better. The region of the Étangs terminates abruptly towards the south by a steep slope. This region is comparatively healthy, except in some narrow humid valleys. The village of Montluel had already attained a moderate degree of salubrity when Nepple wrote. The plains towards the Rhône are divided into two portions: 1. an arid, stony district of a reddish soil, destitute of trees or shrubs; 2. a smaller district, fertile, well-wooded, and populous. The scanty population of the first district is not subject to fever except in those places where the overflow of the Rhône has given rise to pools and marsh. In such localities the disease is endemic and the natives cachectic. In the second or fertile district, comprising Nièvres and Thil, surrounded by marshes, some are always covered with water, while others are constantly dried during the heat of summer. These villages furnish a great number of fever cases, especially of a remittent type, during the months of August, September, and October. The inhabitants do not suffer to the same extent from the malarial cachexia as do the inhabitants of the first zone. This is accounted for by Nepple, partly because they live in more comfortable circumstances, and partly because the marshes do not arise from the clayey nature of the ground, as in the zone of pools, but from the overflow of the river.

As regards the influence of the weather upon the prevalence of fever in the Dombes district, the following are the conclusions of Nepple:—

1*st.* In very warm years fevers are very violent, and often begin by the remittent or even the continued type.

2*nd.* When the temperature of summer is very variable or humidity is dominant, these diseases, although less severe, are more frankly intermittent, and very much more prevalent.

In the hospitals of Châtillon-les-Dombes and of Chalomont, in the centre of the zone of Étangs, malarial fevers formed two-thirds of the admissions. At Montluel, on the slopes, they form about three-sevenths.

Of 678 cases of fever treated during 54 months in the hospital at Montluel, the forms and types were as follows:—

Intermittent,	386	Quotidian,	198
		Tertian,	115
		Quartan,	59
		Pernicious,	14
Remittent,	195		
Continued,	97		

The endemy becomes less severe as we follow the Saône upwards. Besançon, although not free from fever, is as regards malarial fevers the healthiest station occupied by the French army.

Outside these river basins, we may note that the department of Puy-de-Dome, which, according to Hertz, "abounds in swamps," is far from salubrious. The number of deaths from malarial fevers among the troops stationed at Clermont in this department, is abundant evidence of this fact. The moist plain, again, between the Cantal and Forez ranges in Auvergne, is also notably malarious.

Let us now cast a glance at the distribution of the disease in the maritime provinces. Malaria is little known in the departments of Pas-de-Calais, Calvados, Manche, and Côtes-du-Nord, although the first and third of these districts contain extensive tracts of marsh. Calvados, so far as we can learn, is the only one of them that can be called malarious. Nor does the disease become at all common until we reach the mouth of the Loire. Finistère and Morbihan during last century were very unhealthy, but drainage and other sanitary works have led to a great improvement in the public health.

We are informed that malarial fevers and dysentery are rare in Finistère. At Brest, it is true, the admissions into hospital for these diseases are rather numerous, as will be seen by the following table, but the most of the patients come from the Colonies:—

	Malarial Fever.		Dysentery and Diarrhœa.	
	Admissions.	Deaths.	Admissions.	Deaths.
1885, . .	257	7	463	11
1886, . .	333	0	44	8
1887, . .	136	0	86	7
1888, . .	86	0	160	7

Vendée is moderately malarious. The Charente-Inférieure, which is the most marshy department in France, is highly malarious.

Lombard gives the deaths from pernicious fever at Rochefort, in comparatively recent years, as 12·1 per 1000 of total deaths. Rochelle, in the same neighbourhood, also suffers to a considerable extent from malaria.

The departments of Gironde and Landes are, like Charente-Inférieure, low, level, and sandy, with numerous lakes, pools, and marshes. The whole coast line of this region is a hotbed of fever. Bordeaux, as we have already said, is decidedly malarious, but the coast country generally is much more so; although, of late years, drainage and planting have here as elsewhere effected a considerable improvement in the health of this unpromising locality.

In some districts where these works have resulted in almost banishing fever, special circumstances have led to its reappearance. The study of such cases has such importance in relation to the etiology and prophylaxis of malaria, that I may cite the following instance:—"In the report of the Council d'Hygiene de la Garonne, reviewed in the *Annales d'hygiène publique* for 1879, it is stated that intermittent fever, which had almost disappeared from the Commune d'Ares, had again begun to rage there with great severity. A commission, appointed to investigate the causes of this recrudescence, ascribe it to a number of causes, which have all this in common, that they led to excess and stagnation of water in the soil. The danger, on the other hand, from the drying-up of lakes or ponds, is illustrated by what occurred at Bordeaux in 1805, when the ponds at the west end of the town were drained. The result was, that an epidemy of ague broke out, and seized 12,000 of the inhabitants, of whom 3000 died in the space of five months.[1]

The Mediterranean coasts of Aude, Hérault, Gard, Bouches-du-Rhône, and Var, with their numerous lagoons, present many active foci of malaria, which are rendered more intense on account of the high summer temperature, and the dryness of the summer season.

We have already noticed the extreme insalubrity of the department of the Bouches-du-Rhône, which, according to Colin, was during the Roman period covered by flourishing cities and rich and well-cultivated fields. In 1866 malarial fever was epidemic in this department.

The coasts of Aude are flat, the soil mostly calcareous and fertile. It contains a considerable area of marsh, and several lagoons. Hérault, watered by the river of the same name, and by the Orb and Lez, presents, along the shore from Agde to Vidourle, a number of marshy lakes united by the Canal-des-Étangs, and communicating with the sea. The department of Gard to the east presents the same features, the coast line being fringed with extensive marshes. Var differs considerably from the other departments along the coast. It is well watered by numerous streams, but contains little marshy land. Malarious diseases are endemic along the coast of all these departments and for varying distances inland. At Narbonne, which is the centre of the marshy regions of Aude and Hérault, pernicious fevers were credited by Lombard with 22·4 per 1000 of the deaths from all causes. At the present time the mortality is less. Toulon furnishes 13 per 1000; but whether they are contracted on the spot is perhaps doubtful.

[1] *Trans. Epidem. Soc.* 1856.

A few particulars respecting Narbonne will serve at once to illustrate the conditions under which malaria is met with along the Mediterranean coasts of France, and also to exhibit the steps by which a healthy and populous country became infested by malaria, as well as the means by which it has been enabled again to make headway against the infection.[1]

The town of Narbonne, with a population of 13,000, is situated on *La Robine* branch of the *Canal du Midi*. The soil is alluvial, with underlying clay. The annual mean temperature is 16°. Spring has a mean temperature of 15°, summer of 25°, autumn of 17°, and winter of 7°.

In summer the thermometer rises to 33° or 34°, and sometimes even several degrees higher. The summer season is generally very dry. Nearly half the rain falls in autumn, the other half in winter and spring. The rains tend to come in torrents, with considerable intervening periods of dry weather. Under the Roman Empire Narbonne was a prosperous town, situated in a fertile and healthy country. The cutting down of the forests in the thirteenth century, resulting in the conversion of some of the salt lakes into marshes, others into plains, by the alluvial deposits washed down from the denuded hills, alterations in the course of the river Aude, and other circumstances leading to more frequent inundations of the plains, were successive steps on the downward path.

Towards the end of the fourteenth century (1398), we are told that the inhabitants suffered greatly from want of water during the dry weather of summer, the river having lost itself in the mud before reaching Narbonne. In spring, when the snow melted, and again in autumn, during the heavy rains, the country became inundated to such an extent that the inhabitants were confined within the walls of the town, and could not even communicate with the neighbouring villages. The sand collecting towards the mouth of the river formed barriers along the shore, separating the greater part of the ancient lake of Rubrensis from the sea, converting it into a marsh, which was alternately filled during the rains, and left, in parts, exposed during the dry summer weather. As these changes in the physical condition of the country progressed, its ancient salubrity disappeared, the fever-stricken population diminished in numbers, and the prosperity of the town departed. The surrounding country became in many parts a desert.

The efforts that have been made for more than a century, at first somewhat spasmodically, to retrieve the errors of the past, have

[1] Martin, *Essai sur la Topographie Physique et Medicale de la Ville de Narbonne*, Montpellier 1859.

not been without success. Marshes have been dried, the admixture of fresh and salt water has been prevented, the inundations have been limited, deforestation has been arrested, the clearing of the beds of the streams has been carried out, and agriculture has been encouraged. Gradually, as these measures have been proceeding, the public health has improved, and if fever has not been banished, it has diminished in prevalence and above all in virulence.

In 1782 we read of an epidemic of *la fièvre maligne pourprée.* The purple spots covered the whole body. The fever was high, and there was sometimes considerable sweating. The disease was marked by subsultus tendinum, convulsive movements, and by a dry tongue covered with a black or yellow crust. The colour of the skin became livid and the respiration embarrassed. The treatment, by emetics at the commencement, followed by a decoction of chinchona and tamarinds, was so successful when the case was seen early, as to make it doubtful whether this was really an epidemic of typhus or of a special form of malarial fever. Some years later there was another epidemic of *fièvre petéchiale remittente pernicieuse.* The remissions were well marked at the outset of the disease. After the seventh day typhoid symptoms appeared. The disease generally ended by a crisis on the eleventh or thirteenth day. Sweating, or an abundant discharge of urine, led to a favourable termination. When a critical diarrhœa came on the patient was not free from danger. A similar fever was noticed several times towards the close of last century, but not, so far as I know, during this century.

Intermittent and remittent fevers of the ordinary kind have been frequently epidemic, notably in 1810 and in 1825.

We shall mention a few of the circumstances which have in recent years been found to give rise to outbreaks of fever.

Inundations of the plains are often followed by an increase of malarial fever. Rice culture was attempted some years ago at Mandirac, near the city. The greater part of the labourers were attacked with grave intermittents. The manager of the estate lost several members of his family, and the culture had to be abandoned. The commune of Ouveilhan, in the environs of Narbonne, has been ravaged with murderous epidemies of fever each time that its salt lake has received fresh water, whether from extraordinary rainfalls or other causes. Conversely, the salt marshes of Bages and Sigean, near the town, have become less unhealthy since the fresh water from La Robine has been prevented from flowing into them.

As a consequence of the works on the railway du Midi, many of the labourers entered the Narbonne hospital suffering from pernicious fevers and typhoid, neither of which prevailed in the town

at that time. This observation has an important bearing upon the nature of the typhoid fever of warm climates.

At the present day malarial fever at Narbonne is by no means severe. The spleen is seldom affected. Pernicious cases, however, of the algid and choleraic forms occur. Masked ague is by no means uncommon.

The following table, which gives some of the principal death-causes from 1854 to 1857, illustrates the pathology of Narbonne and its neighbourhood. The total deaths during these four years numbered 1775:—

Diseases.	Number of Deaths.	Ratio per 1000 of Total Mortality.
Typhoid Fever,	185	104·2
Intermittent Fever,	26	14·6
Cerebral Fever,	33	18·6
Continued Fever,	9	5·0
Enteritis,	103	58·0
Diarrhœa,	78	43·9
Dysentery,	27	15·2
Phthisis,	100	56·3
General Dropsy,	14	8·0
Liver Disease,	14	8·0
Spleen Disease,	2	1·1

We shall only add the distribution of 57 cases of malarial fever admitted into hospital from 1886 to 1888, as transmitted by Dr. Martin to Dr. Monty:—

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
2	2	1	3	3	2	6	10	13	8	4	3

It will be observed, as bearing upon the health of this region, that the greatest number of deaths from malarial fever among the French troops occurred in those stationed at Marseilles and Montpellier, and these are certainly by no means the most malarious localities in this region. Maurin states that malarial fever has been more frequent in Marseilles since the opening of the canal conveying water from the Durance. This result he ascribes to the infiltration from the canal soaking into the subsoil.

Typhoid Fever is a widely spread and fatal disease in France. The average death-rate in 195 towns, with a total population of 8,575,576, in the three years 1886–88, was 593 per million.[1]

The official statistics [2] do not include towns with a population under 10,000, nor do they include the rural districts, in which a very large part of the French population are located. We are thus without data for estimating the average typhoid death-rate of France

[1] *Statistique Sanitaire: Mortalité par Maladies Épidémiques*, Melun 1889.

[2] *Statistique Sanitaire des Villes de France et d'Algérie*, from 1887, Paris 1889. *Statistique Sanitaire dans les Villes de France*, from 1886, Paris 1887.

as a whole; but, so far as the ground is covered by the returns, it would appear that the mortality from typhoid fever is about three times as high as in England. The higher mortality from typhoid fever in France is confirmed by the military returns. The average mortality among the French troops from 1862 to 1875 was 2·23 per 1000,[1] or about twenty times as high as that of the troops in England.

The following table gives the death-rates in the towns arranged in six groups, according to population, for the three years 1886, 1887, and 1888:—

Groups of Towns.	Total Population.	Ratio of Deaths to 10,000 living. 1886.	1887.	1888.	Average.
38 Towns, with 2,260,945 to 41,007 Inhabitants,	5,768,888	5·3	6·7	5·0	5·67
30 Towns, with 39,600 to 23,491 Inhabitants,	868,590	6·8	7·1	7·0	6·97
41 Towns, with 22,781 to 17,024 Inhabitants,	810,688	5·3	6·4	5·5	5·73
34 Towns, with 16,857 to 14,014 Inhabitants,	516,559	4·6	6·3	6·5	5·83
31 Towns, with 13,992 to 11,620 Inhabitants,	386,566	5·8	9·1	7·1	7·33
21 Towns, with 11,542 to 10,030 Inhabitants,	224,285	5·4	6·6	5·0	5·67
Totals and Means of 192 Towns,	8,575,576	5·4	6·8	5·5	5·93

It will be seen from these figures that the minimum typhoid mortality falls on the two extremes of the scale, that is, on towns with a population above 41,000, and on those with from 11,542 to 10,000 inhabitants. The highest typhoid mortality is met with in the group of towns with a population between 13,992 and 11,620; and the next highest in the second group, with a population of 23,000 to 40,000. The relation of typhoid fever to the size of the towns is not uniform.

The mortality in the great towns varies considerably from year to year, and in different cycles of years, according to the absence or presence of epidemic outbreaks. The following table gives the average typhoid mortality in some of the principal towns in the north, centre, and south of France for 1886–88:—

[1] Colin, *De la fièvre typhoïde dans l'armée*, Paris 1878, and *Archiv. de méd. navale*, vol. xxxii

Average Death-rate from Enteric Fever in certain Towns in the North, South, and Centre of France, 1886–88.

North of Latitude 48°.		Between Latitudes 48°–45°.		South of Latitude 45°.	
Towns.	Death-rate per 1000.	Towns.	Death-rate per 1000.	Towns.	Death-rate per 1000.
Lille, . .	0·17	Nantes, .	0·49	Bordeaux,	0·71
Havre, .	2·33	Dijon, . .	0·38	Toulouse, .	1·02
Paris, . .	0·45	Besançon,	0·99	Pau, . . .	0·41
Nancy, . .	0·52	Rochefort,	0·76	Cette, . .	1·17
Brest, . .	0·97	Limoges, .	0·31	Marseilles,	1·10
Troyes, .	0·88	Lyons, . .	0·29	Toulon, .	0·56

The disease was unusually prevalent in Havre during these three years. In Brest enteric fever is endemic in a severe form, causing, according to Borius, 10 per cent. of the total mortality.[1] Bourges, in the centre of France, the lower parts of which are exposed to marsh miasm, is said to have an average typhoid mortality of 1·8 per 1000.

It will be observed that most of the towns situated in the south of France suffer very severely from typhoid fever. Lombard concludes, from his analysis of the returns of 1855, 1856, and 1857, that the number of deaths from typhoid increases as we advance from north to south, or from west to east. His statement will be seen to be supported by the distribution of the disease in 1886 :—

Average Death-rate per Million Living in the 222 Towns of France, having a Population of 10,000 Inhabitants and over, in the different Geographical Regions of France in 1886.

Region.	Population.	Enteric Death-rate.	Region.	Population.	Enteric Death-rate.
North, . .	4,091,053	400·4	West, . .	593,886	442·8
East, . . .	1,034,358	438·9	North-West,	446,966	724·9
North-East,	471,472	612·9	South-West,	642,349	663·2
South-East,	916,736	823·5	Centre, . .	330,567	529·4
South, . .	370,756	1070·8			

The decreasing frequency of the disease as we attain higher latitudes, even under what may be assumed to be similar conditions of age, mode of life, and social condition, is perhaps better illustrated by the typhoid mortality among the troops, as given in the following table compiled by Marvand,[2] who remarks that the frequency

[1] *Archiv. de méd. nav.* vol. xxxi. p. 310. [2] *Annales d'hygiène pub.*, Nov. 1883.

and gravity of typhoid fever in the French army depends in the main on two conditions, viz. the latitude and climate, and the greater or lesser agglomeration in the great centres of population. It will, however, be observed that, as among the civil population, the mortality from typhoid among the troops is not determined entirely by the size of the garrison town:—

Proportion of Deaths from Typhoid Fever per 1000 in the different Corps d'Armée, 1875–79.

1.	XVth Corps (Marseilles),	5·1
2.	XIXth ,, (Algéria),	5·0
3.	XVIth ,, (Montpellier),	4·8
4.	Government of Paris,	4·7
5.	XIth Corps (Nantes),	4·4
6.	IVth ,, (Le Mans),	3·9
7.	IIIrd ,, (Rouen),	3·8
8.	Xth ,, (Rennes),	3·0
9.	XIIIth ,, (Clermont),	3·1
10.	XIVth ,, (Lyons),	2·7
11.	VIth ,, (Châlons),	2·6
12.	IXth ,, (Tours),	2·5
13.	XVIIth ,, (Toulouse),	
14.	IInd ,, (Amiens),	2·4
15.	XIIth ,, (Limoges),	2·3
16.	Vth ,, (Orléans),	1·7
17.	VIIth ,, (Besançon),	
18.	XVIIIth ,, (Bordeaux),	1·6
19.	VIIIth ,, (Bourges),	1·3
20.	Ist ,, (Lille),	1·0

Having noticed the distribution of the typhoid mortality as regards latitude, longitude, and density of population, we shall now give the monthly distribution of the deaths from the disease in Paris (1868–78) and in Marseilles (1886–87).

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec
Paris,[1]	6·2	5·7	4·6	4·9	4·2	4·9	6·9	12·3	13·5	12·5	13·6	10·3
Marseilles,[2]	6·7	4·2	4·4	4·5	6·5	7·0	10·4	14·6	14·6	11·0	8·2	7·8

Here, again, we find evidence of the distinctly seasonal character of the fever. The rise appears to begin earlier, and the curve to be marked by a greater amplitude, in Marseilles than in Paris.

It would appear that the regions most exposed to typhoid epidemies are not those where the disease is most prevalent as an endemic malady, but rather the reverse. The following is the order as regards liability to epidemies, beginning with those where they are most frequent:—1. The north-east. 2. The south-east. 3. The north-west. 4. The south-west. 5. The Mediterranean coasts.[3]

Diphtheria and Croup caused an average death-rate, in 195 towns of France, of 637 per million living, for the three years 1886–88.

Taking the same groups of towns, arranged according to size, as

[1] Besnier, *Union méd.*, Paris 1867–79, quoted by Hirsch.
[2] *Statistique Sanitaire*, Paris 1886 and 1887. [3] Rey, *Géographie méd.*, Paris 1872.

have been already defined when dealing with typhoid fever, we find the mortality per 10,000 inhabitants on each group to be as follows :—

Proportion per 10,000 Inhabitants.				
	1886.	1887.	1888.	Average.
Group i.,	6·1	6·7	6·9	6·60
Group ii.,	5·7	5·1	6·7	5·86
Group iii.,	4·7	6·9	5·6	5·76
Group iv.,	4·1	7·0	6·8	6·00
Group v.,	5·2	8·8	6·8	6·93
Group vi.,	4·3	4·2	5·5	4·70
Means,	5·7	6·6	6·8	6·37

From this table we judge that in France there is no fixed relation between the size of towns and the prevalence of diphtheria. During the three years with which we are dealing, the lowest death-rate was in the group of smallest towns, while the group standing next in order with only a slightly larger population had the highest death-rate. The largest towns also appear to have a heavy death-rate from diphtheria and croup. The following was the distribution of the disease in 1886 in 222 towns of France arranged according to geographical regions :—

Regions.	Deaths per Million.	Regions.	Deaths per Million.
North,	579·1	West,	447·9
East,	458·2	North-West,	872·3
North-East,	339·3	South-West,	242·8
South-East,	963·2	Centre,	435·6
South,	604·2		

Diphtheria, in the year to which the table refers, had two centres of intensity,—the north-west along the shores of the Channel, and in the south-east on the Lower Rhône, stretching east to Nice, and including the island of Corsica. Although diphtheria was somewhat more prevalent in the south than in the north during that particular year, the small mortality in the south-west bordering on the Pyrenees forbids us to attach much importance to latitude as influencing the prevalence of the disease. Equally ambiguous is the influence of longitude. In the north it is the west that suffers more ; in the south it is the east.

We shall add a table giving the death-rates from diphtheria in some of the principal towns of France arranged according to latitude:—

AVERAGE DEATH-RATE FROM DIPHTHERIA IN CERTAIN TOWNS IN THE NORTH, SOUTH, AND CENTRE OF FRANCE, 1886-88.

North of Latitude 48°.		Between Lat. 48° and 45°.		South of Latitude 45°.	
Towns.	Death-rate per 1000.	Towns.	Death-rate per 1000.	Towns.	Death-rate per 1000.
Lille, . .	0·397	Nantes, .	0·600	Bordeaux,	0·487
Havre, .	0·587	Dijon, . .	0·31	Toulouse, .	0·407
Paris, . .	0·710	Besançon,	0·247	Pau, . .	0·350
Nancy, .	0·227	Rochefort,	0·553	Cette, . .	0·983
Brest, . .	0·607	Limoges, .	0·407	Marseilles,	1·390
Troyes, .	0·453	Lyons, . .	0·400	Toulon, .	1·130

The following was the monthly percentage of 3505 cases occurring in thirty-five of the largest towns in 1886:—

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11·9	10·3	11·2	10·0	9·4	6·3	7·0	5·4	3·9	6·9	7·0	10·4

Diphtheria is most fatal during the four months December to April, and becomes very rare in August and September.

Whooping-Cough is by no means fatal in France; the average death-rate in the 195 towns from which we have returns during the years 1886–88 having been 180 per million. During these years the disease was most fatal in towns of the second and last groups.

Diarrhœal Diseases.—Under the heading "diarrhée, gastro-entérite," are included infantile diarrhœa, cholerine, and dysentery. Omitting twelve towns for which the returns are incomplete, the death-rate from this class of diseases in 216 towns, having a total population of 8,998,514, was 2068·1 per million in 1887. The deaths from cholera, diarrhœa, and dysentery in England in 1884 were in the ratio of 1003 per million living, and including enteritis, 1122 per million; and it may be remarked that diarrhœal diseases were more than usually fatal in England that year. In estimating, however, the comparative frequency of diarrhœal diseases in the two countries, it must be remembered that the figures for England represent the death-rate of the whole country, while those for France refer only to towns with a population of above 10,000 inhabitants. In England the diarrhœal death-rate of the towns is about twice as high as that of the country.[1] If the same rule obtains in France,

[1] In 1884, for example, the death-rate per 1000 from diarrhœal diseases was for the twenty-eight great towns 1·21, and for the rural districts 0·72.

we should be warranted in concluding that diarrhœa is about equally fatal in the two countries. Yet, on comparing the death-rate in Paris from this class of diseases with those in London, it will be found that the French capital has a mortality nearly twice as great,—the average death-rate in Paris (1886–87) being 1908 per million; that of London (1871–80) being 980 only.

In 1887 the mortality from diarrhœal diseases in five groups of towns with a gradually diminishing population was as follows:—

49 towns with a total population of			6,232,341;	death-rate,	2·15	per 1000.
45	,,	,,	,, 1,088,008;	,,	2·12	,,
40	,,	,,	,, 683,321;	,,	1·62	,,
40	,,	,,	,, 544,928;	,,	1·72	,,
42	,,	,,	,, 449,916;	,,	1·89	,,

The death-rate in the largest towns is very considerably higher than in the smaller ones; but the disease, from some disturbing cause, does not decrease in regular proportion as the towns diminish in population.

The following table gives the regional death-rate per million from diarrhœa in France for 1886:[1]—

Regions.	Deaths per Million.	Regions.	Deaths per Million.
North, . .	1906	West, . .	426
East, . . .	979	North-West, .	602
North-East, .	2619	South-West, .	805
South-East, .	532	Centre, . .	426
South, . .	812		

Diarrhœal diseases are excessively frequent in the north-east, although there are only three towns of any size included in this region, viz. Rheims, Nancy, and Troyes. The position held by the north in this list, as compared with the south, is explicable by the number of large manufacturing towns it contains. Comparing the figures for some of the towns in the south-east with those for other years, I am inclined to think that the figures given above rather understate than otherwise the diarrhœal mortality of this region.

Dysentery.—Judging from the statistics of individual towns, dysentery is more fatal in the south than in the north. Thus we find the ratio of deaths from dysentery to 1000 deaths from all causes to be, in Nancy, 2·4; in Paris, 6·0; in Bordeaux, 10·1; in Lyons, 18·2; in Narbonne, 15·2. In Lille, in the extreme north, dysentery is said to be almost unknown. Several of the localities where dysentery may be said to be endemic, such as Brenne, Sologne, and Medoc, are dis-

[1] For the different regions, population, etc., see *Statistique Sanitaire des Villes de France et d'Algérie*, Paris 1887.

tinctly marshy. The disease, however, is also prevalent in the southern towns of Marseilles and Toulon, apart from marshy conditions.

Epidemic dysentery, on the other hand, is comparatively rare in the south. Provence is seldom visited by these outbreaks. It is in the north-east and north-west of the country that these epidemics have chiefly occurred. It will thus be seen that the regions of endemic and epidemic dysentery do not correspond.

Asiatic Cholera has been eight times epidemic in France, viz. in 1832, 1834, 1837, 1848, 1850, 1853, 1867, and 1884–86.

The following towns have enjoyed an absolute or relative exemption: Rouen, Versailles, Lyons, and Sedan. The Vosges in the north-east, and some of the mountainous districts of the south-east, have almost escaped during these epidemics.

Typhus Fever can scarcely be said to be endemic in France, but it has broken out in an epidemic form several times during this century.

Miliary Fever.—This mild form of "sweating sickness" has been frequently epidemic within limited areas in France during the past and present centuries. Hirsch states that no fewer than 194 epidemics of this strange malady have been recorded between the years 1718 and 1874. Many of these have been limited to a single village, or to a few localities. The north-east and extreme north have been the regions which have suffered most severely.

Epidemic Cerebro-spinal Meningitis.—France has formed the principal European centre of this deadly disease, which has been observed in numerous localities from 1839 to 1842, especially in the garrisons and garrison towns. A second epidemic period began in 1846 and continued until 1850. A third, but quite limited outbreak, occurred in 1867–68. Most of the epidemics have occurred in winter and spring.

Smallpox is never entirely absent from the great centres of population. The average mortality in 195 towns (1886–88) was 0·34 per 1000. The disease is specially fatal in the large towns.

Measles.—The average death-rate for the three years 1886–88 in the towns was 0·47 per 1000. The monthly distribution of the disease in Paris we have already given when treating of its seasonal prevalence in England. It is, upon the whole, most fatal in the large towns.

Scarlatina gave an average annual death-rate of 0·97 per 10,000, or 97 per million, in 195 of the great towns for the years 1886–88, and which is rather less than one-seventh the average death-rate in England from this disease for the ten years ending 1880, which stood at 720 per million. Lombard remarks the low mortality from scarlatina in France during the three years 1855–57,

and states that no severe epidemy of the disease was observed in France from 1830–70.

Pneumonia is returned along with broncho-pneumonia in the official statistics of the French towns. In 1887 the deaths in thirty of the great towns, with a total population of 5,137,453, from these two diseases, were in a ratio of 2097·7 per million living.[1] In ten towns north of the 48th parallel, with an aggregate population of 3,104,369, the ratio was 1919·9; in ten towns between the 48th and 45th parallels, with an aggregate population of 935,168, it was at the rate of 2033·8; in ten towns south of the 45th parallel, with a total population of 1,097,916, the ratio was 2655 per million; from which we conclude that, in the great towns at least, pneumonia and broncho-pneumonia are more fatal in the south than in the north. In London the death-rate from pneumonia in 1884 was 1058 per million.

Bronchitis, acute and chronic, was the cause of 1711·7 deaths per million in 1887 in the thirty great towns already referred to, as against the London ratio (1884) of 2291 per million. In the ten towns north of parallel 48 the proportion was 1660·8; in the ten towns between parallels 48 and 45 it was 1877·7; and in the ten towns to the south of parallel 45 it was 1714·1.

If, again, we compare the five towns in the north, Paris, Lille, Havre, Rouen, and Roubaix, with Lyons, Marseilles, Toulouse, Bordeaux, and Nice in the south, we find that the deaths from bronchitis were 1535·9 in the northern, and 1864·1 per million in the southern towns. This points to the greater prevalence of bronchial affections in the south.

Acute bronchitis, which is principally a disease of infancy and childhood, caused 669 deaths per million living in the ten northern towns, 719·6 in the towns in the middle zone, and 819 per million in the southern towns. There is thus a steady increase in the acute form as we advance from north to south. The ratio in the mortality from the chronic disease affecting adults is different. In the north it is 991; in the middle region, 1158·17; and in the south, 895·3 per million. The chronic form of bronchitis is thus seen to be most prevalent in the centre, and least prevalent in the south of France.

Combining the acute and chronic forms of bronchitis and pneumonia, the death-rate from these diseases, which include the

[1] The following are the thirty towns upon which the calculations respecting pneumonia and bronchitis have been made:—(1) North: Paris, Amiens, Rouen, Havre, Rheims, Lille, Troyes, Nancy, Rennes, Brest. (2) Middle zone: Rochefort, Nantes, Angers, Bourges, Dijon, Besançon, Lyons, Grenoble, Limoges, Rochelle. (3) South: Bordeaux, Bayonne, Pau, Toulouse, Nîmes, Marseilles, Toulon, Aix, Nice, Avignon.

larger number of diseases of the respiratory organs, we find the death-rate for the thirty towns with which we are dealing to have been in the proportion of 3809 per million. The death-rate from bronchitis and pneumonia in London in 1884 was 3349 per million.

Lombard found the deaths from bronchitis to form 49·5 per 1000 of the total mortality in the north, and 32·2 only in the south,—a result different from that which I have arrived at from the returns of 1887. It is due to his intimate knowledge of the subject to give his conclusions, although they do not agree with mine.

Phthisis caused a mean death-rate of 4393 per million in 1887 in the three northern towns of Paris, Lille, and Havre; in the four southern towns of Marseilles, Bordeaux, Nice, and Nîmes, the ratio was 3307 per million. Comparing ten towns along the coasts of the Bay of Biscay, from Brest to Bayonne, with ten along the eastern frontier, from Rheims to Grenoble, the mortality from phthisis is in the ratio of 2848·7 per million in the west, and 2818·6 in the east. These figures show a greater prevalence of phthisis in the north as compared with the south; while, as regards the eastern and western regions, the proportions indicate no decided difference between the two regions.[1]

Goitre is endemic in the Alpine departments. Hirsch estimates the proportion of the goitrous at 10·4 per 1000 of the total population of France, and that of cretins and idiots at 3·3.

Leprosy.—A few isolated cases of leprosy are still met with on the coasts of the Mediterranean.

Pellagra is endemic to some extent in the Gironde, Landes, Hautes-Pyrénées, Basses-Pyrénées, and Aude, where maize forms an important part of the food of the poorer classes.

Scrofula is very common in many parts of France. According to the recruiting lists (1831–53), 1 per cent. of those examined suffered from this malady. It prevails most in the south-eastern departments of the Hautes-Alpes, Isère, Rhône, Loire, Haute-Loire, Lozère, Cantal, and Aveyron; to a less, but still to a considerable extent, it prevails in the departments of Sâone-Loire, Allier, Puy-de-Dome, Creuze, Nièvre, and Loiret, extending from Auvergne through Bourbonnais and Nivernais. Another focus of the disease exists in Franche Comté; another in Haut-Rhin, Bas-Rhin, and Vosges; while still another is met with in the coal districts of the Department du Nord. (Hirsch.)

[1] Here are Lombard's conclusions respecting the distribution of phthisis in France: "La phthisie pulmonaire est à son maximum de fréquence dans le nord comparé au midi; dans l'occident comparé à l'orient, tandis qu'elle est plus rare au centre de la France qu'à l'occident ou sur les bords de l'océan; elle est également moins fréquente au midi et sur les bords de la Méditerranée, sur les montagnes que dans la plaine, dans les petites que dans les grandes villes."—*Op. cit.* vol. ii. p. 519.

CHAPTER XV.

SWITZERLAND.

Geography.—Switzerland is situated between 45° 48′ and 47° 49′ N. lat.; and between 5° 55′ and 10° 30′ E. long. It has an area of 15,721 square miles, with a population in 1886 of 2,940,602.

The Jura range on the north-west forms its western boundary. The Alps run from east to west along its southern frontier, spreading their ramifications over more than half the area of the country. In the angle formed by the ranges of the Jura and the Alps lies the table-land of Switzerland, which has a mean elevation of about 1400 feet above the sea-level. The inhabited country consists of this table-land, and of the numerous mountain valleys drained by the Rhône, the Rhine, the Ticino, and their tributaries. The principal lakes are,—Lake Geneva (1218 feet), Lake Neuchâtel (1437 feet), Lake Bienne (1427 feet), Lake Constance (1299 feet), Lake Zurich (1332 feet), Lake Lucerne (1430 feet), Lake Thun (1923 feet), and Lake Brienz (1946 feet). The altitudes of these lakes indicate generally the height above the sea-level of most of the more densely inhabited localities. The valleys of the Engadine have an elevation of from 6000 to 6700 feet.

The country is divided politically into twenty-five cantons, to which we shall have frequently to refer, but which we need not enumerate here. Some of these are industrial, others agricultural, while in many both manufactures and agriculture are carried on.

Climatology.—The mean annual temperature is here determined by altitude, and by the physical features of special localities. The following table gives the temperature of five stations according to altitude:—

Locality.	Latitude.	Altitude. Mètres.	Temperature. Jan.	April.	July.	Oct.	Year.
Geneva,	46° 12′	408	0·1	9·4	19·3	9·8	9·5
Gersau (Lake Lucerne),	46° 59′	440	0·8	9·8	19·0	9·7	9·6
Zurich,	47° 23′	470	−1·2	9·1	18·7	8·5	8·6
Berne,	46° 57′	574	−1·8	8·6	18·2	8·1	8·1
St. Bernard,	45° 52′	2478	−9·0	−3·3	6·2	−0·5	−1·8

In the Rhine basin the heavy rains fall in summer. In the Rhône valley the rains are pretty equally distributed over the spring, summer, and autumn seasons, winter being the period of minimum rainfall. In the Ticino the winters are dry and the autumns rainy.

VITAL STATISTICS.—The marriage-rate for the ten years ending 1886 was 13·9; the birth-rate, 29·3; and the death-rate, 21·7 per 1000. Switzerland thus ranks amongst the healthier countries of Europe. It may be remarked that the average death-rate of Switzerland is precisely the same as that of the Netherlands for the same period. So that the lowest-lying country in Europe is, as regards health, no worse off than the most elevated country.

The seasonal distribution of the deaths in 1876 are thus given by Lombard: winter, 27·54; spring, 27·07; summer, 23·83; autumn, 21·56. The effect of increasing altitudes upon the distribution of the mortality is to augment the proportions in the winter and the spring, and to diminish those of summer and autumn.

PATHOLOGY.—In sketching the pathology of Switzerland, I shall rely mainly on late official returns; but in respect to the distribution of malaria, and many points connected with the influence of altitude, I shall follow the guidance of Lombard, who is the greatest living authority upon the diseases of Switzerland.

Malaria.—From the elevated and mountainous character of the country, malaria is found to play a very insignificant *rôle* in the pathology of Switzerland, and this notwithstanding the existence of numerous marshy districts. The more extensive marshes on the plains have, however, been drained during this century, and the land so reclaimed placed under cultivation, with the result that ague has disappeared from many localities where it was formerly endemic. In 1885 only nine deaths are registered from malarial fever, which shows that the disease is of a mild nature. In the same year two deaths are recorded from "splenite."

Basel, which is fertile and well cultivated, is free from malaria. The same may be said of Berne, although a few cases of fever occur in the Oberland, on the borders of Lakes Thun and Brienz, and along the banks of the Aar to Meyringen. The marshy valley of Travers in Neuchâtel, at an altitude of about 2440 feet, furnishes a few cases of ague. Freiburg is almost entirely free from fever.

At Villeneuve, in Canton Vaud, which is low, and liable to inundations, malarial fever is, to some extent, endemic. The cases reported from some localities, at altitudes of 4000 to 6260 feet, are supposed by Lombard to be imported. In Canton Valais the Rhône is enclosed, as it were, between two walls of rock, which raises the summer temperature of the valley, which is also liable to be

submerged by inundations of the river. Here malaria is endemic in the plains, especially from St. Maurice downwards to Lake Geneva. Above St. Maurice fever occurs with varying degrees of frequency as high as Sierre; but Haut-Valais is practically free from malaria. In Geneva the cases of fever now and again met with are mostly imported. In Ticino, on the Italian frontier, malarious diseases are much more common. Thus they are met with in the districts of Mendrisio and Lugano, and still more frequently in Bellinzona and Locarno. In the latter districts numerous malarious *foci* exist. It is stated that the great inundations of 1868, which covered all the marshes, put an end to the fevers, but they reappeared when the cuttings for the St. Gothard railway commenced. In the Levantine valley there are many malarious localities, and also at and near Malvaglia, in the district of Blenio, especially along the marshy banks of the Brenno.

Enteric Fever.—The death-rate from enteric fever throughout the country (1881–85) was 291·0 per million, and 510 in the fifteen towns having a population over 10,000. During the previous quinquennial period (1876–80) the death-rate in the towns was still higher, viz. 530 per million. These figures, which refer only to duly attested cases, show that enteric fever is far from rare in Switzerland.

In considering the distribution of disease in Switzerland, the point of greatest interest is to trace in what way a given disease is affected by altitude. The problem, however, is not so simple as it seems to be, inasmuch as other factors, which affect health in a still greater degree, such as the sanitary condition of the towns and villages, the density of the population, and the occupations of the inhabitants, come in to complicate the problem.

The purity of the air, which is associated in our minds with high altitudes, is the result of the absence of vegetable and animal contamination. The air in a densely-populated locality is not necessarily purer because the locality is so many thousand feet above the sea-level. Two elements alone seem peculiar to high altitudes, viz. diminished density of the air, and a decrease in the temperature. The free circulation of the air, which is characteristic of the mountain slope or elevated plain, is wanting in the confined mountain valley. In the same way, although the mountain slope is usually well drained, the mountain valley is often damp and marshy. When we inquire into the effects of altitude on the prevalence of a disease, it is only by comparing localities as much as possible under the same conditions that the influence of elevation upon health can be determined. In a few places, as in Berne, it would seem as if typhoid fever is less prevalent in the higher districts.

Thus Lombard points out that in the years 1864, 1865, and again in 1876, enteric fever was less fatal in the Oberland and in the Alpine regions than in the lower districts and in the valleys of the Jura; but these differences, even if constant, may find their explanation in social conditions rather than in altitude. This view is rendered the more probable by the fact that in some cantons the reverse relation has been observed. Thus, in the Canton Valais, it is stated that "typhoid fever is met with as well in the low as in the high regions, where epidemies often develop with great intensity, as was observed some years ago in the most elevated permanently inhabited spot in Europe, the Monastery of St. Bernard, where several of the monks were successively attacked."

The average enteric fever death-rate in the mountainous and agricultural canton of Uri (1885–88) was 222·0, and that of the Unterwalden, 250·0; while for the same period the ratio was 225·6 for Geneva, with its comparatively dense population and manufacturing industries. In Berne it was 185·8; in Basel (town), 254·5; and in Zurich, 86·8 per million. There is thus no evidence that altitude, apart from other conditions, exercises any influence on the prevalence of enteric fever; and it is further to be noticed that the agricultural suffered from this disease more severely than the industrial cantons during these three years.

The following table gives the monthly percentage of 5080 cases observed during twenty-four years at Basel, from which it will be seen that enteric fever attains its maximum prevalence in the months of August, September, and October, and its minimum in March, April, and May:—

Monthly Percentage of Hospital Cases of Enteric Fever at Basel.

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
6·5	4·7	5·1	3·9	5·6	10·4	9·8	11·8	12·2	12·3	9·2	8·3

As respects the influence of local conditions, Socin found that at Basel the low and elevated districts suffered equally, whether they were near to or at a distance from the Rhine.

Diphtheria and *Croup.*—Diphtheria did not occur as an epidemic disease in Switzerland until the second half of the eighteenth century. Hirsch notices a severe outbreak of the disease in the Simmenthal in 1752. In 1826 it was again prevalent in Geneva and Canton Vaud; but we have no more accounts of its epidemic prevalence until 1854, when it broke out in Canton Zurich. Since the year 1881 it has taken a wider extension in Switzerland, giving rise to a mean mortality of 639·2 per million in the years 1881–85. During the same period the mortality in the principal towns from diphtheria

and croup was in the ratio of 750 per million—falling in 1886–88 to 403 per million.

Altitude has no appreciable influence on the prevalence of diphtheria. Thus, in Canton Grisons, the average death-rate from diphtheria and croup (1885–88) was 486·3; in Uri, 270·2; in Schwyz, 360·4 per million. These are hilly and agricultural cantons. In the industrial cantons of Geneva the mortality was much less, viz. 173·8 per million; in Basel (town) the ratio was 341·6; and in Basel (country), 490·8 per million. These figures show that in Switzerland some of the elevated, sparsely-peopled districts suffer more than the lower-lying and densely-peopled industrial centres.

Typhus is not endemic in Switzerland, although it has been several times epidemic in some localities during this century. In 1885 four deaths were ascribed to typhus.

Relapsing Fever has never been observed in Switzerland. *Miliary*, or Sweating Fever, which has prevailed at different times in France, has never extended into Switzerland.

Smallpox, Measles, and *Scarlet Fever* present nothing peculiar, either as respects their frequency, fatality, distribution, or seasonal incidence. During the five years 1881–85 measles and scarlet fever were considerably less fatal than in England; and they press with greater severity on the town than on the country districts.

Whooping-Cough is moderately fatal, causing (1881–85) 240·2 deaths per million living, and in the principal towns 270 per million.

Erysipelas, which is specially common in the months of February, March, April, and May, caused an average death-rate of 53·0 per million from 1881–85.

In 1885, *Cerebro-spinal Meningitis* is reported to have caused 26 deaths. There is room to doubt if the deaths were really caused by the epidemic disease, inasmuch as Switzerland has almost entirely escaped when the malady has been epidemic in France and Germany.

Influenza has frequently been epidemic in Switzerland, and has proved as severe here as in other countries.

Phthisis takes a leading place among the diseases of Switzerland, and it appears, taking the country as a whole, to be rather increasing than diminishing in frequency. In the five-yearly period 1876–80, the mortality from pulmonary phthisis was in the ratio of 1988 per million; in 1881–85 it appears to have risen to 2080 per million living. In the principal towns the rate for the former period was 3288·4, in the latter period (1881–85) it stood at 3230·3 per

million, and in 1886–88 it fell to 3097 per million. If the phthisis mortality in the country generally has slightly increased, that of the principal towns has been diminishing, although it is still much in excess of that of the country.

The following table by Hirsch, founded upon Müller's researches,[1] exhibits the influence of altitude and occupation on the prevalence of phthisis in Switzerland:—

TABLE SHOWING THE DEATH-RATE FROM PHTHISIS IN SWISS TOWNS AND VILLAGES.

Elevation in Mètres.	Industrial Cantons.	Mixed Cantons.	Agricultural Cantons.	Average.
200–500	2·7	1·85	1·4	2·15
500–700	3·0	1·55	1·2	1·9
700–900	1·35	1·7	0·7	1·0
900–1100	1·5	1·9	1·9	1·2
1100–1300	2·3	2·3	0·7	1·9
1300–1500	...	1·4	0·6	0·8
1500–1800	...	1·3	0·7	1·1
	2·55	1·7	1·1	1·86

The preponderating influence of occupation and agglomeration on the prevalence of phthisis, is evident from the fact that the average mortality in the industrial cantons at corresponding elevations is twice as high as in the agricultural cantons. It will be observed that, although there is a decrease in the death-rate from phthisis as we ascend to higher elevations, this decrease is neither regular nor continuous. There is, in fact, a zone situated somewhere between 900 and 1300 mètres in which the mortality is higher than at greater or lesser elevations. The existence of this zone is confirmed by Lombard's researches, which, however, point to a steady decrease from 200 up to 899 mètres, then a gradual increase from 900 to 1499 mètres, and finally a second fall in the phthisis mortality in the zone lying between 1500 and 1800 mètres. This peculiar distribution cannot be accepted as an ultimate fact, although its explanation has yet to be given. Lombard remarks on the frequency of phthisis in the cantons consisting of elevated plains, such as the Grisons and Valais, compared to what is observed in the mountainous regions of Uri and the Unterwalden, and in the low districts of the Ticino. The Valais, however, has by no means a high mortality, even among the agricultural cantons, if we are to judge by the average death-rate during the four years 1885, 1886, 1887, 1888, when it reached only 938·5; Uri having a ratio of 1025·0; Unterwalden (high and low), of 1495·6; Grisons, of 2206·5; Schwyz, of 2390·0; and Freiburg, of 1654·0 per million. Of the mixed cantons, Ticino had a ratio of 1690·3; Zurich, of 2213·5; Aargau, of 2110·5; and Berne, of

[1] *Die Verbreitung der Lungenschwindsucht in der Schweiz*, 1876.

2308·0. The death-rates in the industrial cantons also varied considerably; Basel (town), for example, had a ratio during the four years mentioned above of 3161·5; Geneva, of 3123·2; Basel (country), of 2120·0, and Neuchâtel, of 2136·7 per million living. Perhaps the death-rate in the Grisons is augmented by the deaths of phthisical visitors to the Engadine; but it is difficult to account for the high mortality of Schwyz, which is hilly and agricultural, with a sparse population.

Pneumonia and *Pleurisy.*—The deaths from pneumonia in Switzerland in 1885 numbered 1669·4, and those from pleurisy 186·4 per million living,—proportions very considerably in excess of those in England. Hirsch gives the proportion of deaths from pneumonia in the Upper Engadine (1861–70) at 1·8 per 1000, and in Geneva (1843–45) at 1·3 per 1000. As regards Neuchâtel, Dr. Cornaz found pleurisy to augment in frequency with the altitude, and pneumonia to be most common at medium altitudes; but it is very doubtful whether these generalisations will stand the test of wider and longer investigation. It is remarkable that in 1885 the hilly cantons of the Unterwalden had the highest death-rates from pneumonia and pleurisy,—the proportions having reached 2471·8 and 429·8 respectively,—while Aargau, the least hilly of the cantons, followed next as regards the pneumonic death-rate with a ratio of 2387·4. Valais had the smallest death-rate from both diseases, viz. 776·4 for pneumonia and 88·4 for pleurisy. Geneva and Basel (town), situated at comparatively low elevations, and industrial, had death-rates from pneumonia of 1508 and 1587 per million respectively,—rates under the average of the country generally. In Switzerland, unlike England, the greatest mortality from pneumonia does not appear to take place in the great industrial centres.

Acute Bronchitis furnished, in 1885, a death-rate of 486·4, and *Chronic Bronchitis,* of 999·4, or a combined rate of 1485·8 per million. There can be no doubt that both forms of the disease are less prevalent in the agricultural than in the industrial and mixed cantons. Taking acute bronchitis alone, the mortality per million in 1885 in six industrial cantons,[1] with an aggregate population of 434,441, was 483·4; while in eight agricultural cantons,[2] with an aggregate population of 798,249, the ratio was 367·1. It is impossible to say how far the lesser prevalence of acute bronchitis in the agricultural cantons is owing to the greater purity of the air as compared to that of the industrial and mixed cantons, and how far

[1] Outer Appenzell, Glaris, Neuchâtel, Basel (town and country), Geneva.

[2] Lucerne, Schwyz, Unterwalden, Vaud, Freiburg, Grisons, Uri, Valais.

it is to be ascribed to the out-door life of the agricultural classes, by which they become seasoned, as it were, to changes of weather. Acute affections of the respiratory organs attain their maximum in the months of February, March, and April,—the actual maximum, and a well-marked one too, occurring in March.

The following is the distribution of 6633 cases, being the average for the five years 1881–85 :—

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
824	866	1000	857	657	406	266	213	220	305	409	610

A special form of disease, called "alpenstich," has been repeatedly observed as an epidemic in Switzerland. It is a pleurisy or pleuro-pneumonia accompanied with typhoid symptoms, and running a rapid course, often to a fatal termination. It has been most frequently observed in the higher valleys of the Alps.[1]

Emphysema and *Asthma* are very common in the high regions—the *asthma montanum* is the name given to the disease. The prior of St. Bernard informed Lombard that all the inmates of the monastery become emphysematous and asthmatic after a certain number of years.

Dysentery is practically unknown in Switzerland at the present day. I do not find a single case of death from this disease recorded for 1885 or 1888. Lombard states that epidemics of dysentery, which have been observed at long intervals, have been limited to the zone lying between 700 and 800 mètres.

The Enteritis of Infants caused a mortality in 1886–88 of 1129·3 per million. The disease is considerably more fatal to males than to females. It is much less prevalent in the Grisons, in Uri, in Valais, and in the Unterwalden, than in Basel, Geneva, or Neuchâtel. We may here safely acknowledge the favourable influence of altitude and its associated conditions in reducing the frequency of the disease; but it is not very clear why Valais should have the low death-rate from infantile enteritis of 287·0, while the ratio for Unterwalden reaches 812·0; or, again, why Freiburg should have a higher enteritis death-rate than Geneva, and Schwyz one almost as high.

Rheumatic Fever occasioned a mortality in 1888 of about 26 per million. This does not appear to be a high rate; but, as the English returns combine rheumatic fever and rheumatism of the heart, no exact comparison is possible. In Geneva the deaths from acute rheumatism are much in excess of the average.

Organic Heart Diseases caused, from 1881–85, an average mortality of 878·9 per million in the country generally. In the principal towns the rate was 1126 per million. Heart diseases are

[1] Guggenbuhl, *Der Alpenstich endemisch im Hochgebirge der Schweiz*, Zurich 1838.

thus considerably more common in the towns than in the country; and amongst the towns, Zurich, Berne, Lausanne, and, above all, Geneva, show the highest death-rates from this class of affections.

Cancer appears to be considerably more fatal in Switzerland than in England.

Syphilis is reported to have caused 81 deaths in 1885, which gives a ratio of about 27 per million living.

Scrofula gave rise in 1885 to 178 deaths,—a proportion of 60·8 per million living. It is stated by Lombard to be particularly prevalent in the low or moderately elevated regions, and on the slopes of the Jura and of the Alps, especially in connection with badly built and imperfectly ventilated dwellings and insufficient nourishment.

Rickets caused 55 deaths, and *Diabetes* 19·8 deaths per million living in 1885.

Anœmia is not uncommon, causing about 95 deaths per million.

Goitre and *Cretinism.*—Switzerland forms one of the great endemic centres of goitre in Europe. In 1868 the cretins were estimated to form 1·7 per 1000 of the population. The cantons of Uri, Valais, and Berne contain the largest number; while Lucerne, Neuchâtel, and Ticino are those that suffer least. Wherever cretinism exists, goitre is also endemic; but the reverse does not hold good, for goitre is not uncommon in Geneva, while cretinism is rare.

It is in the valleys of the Alps that both diseases are most common; while those of the Jura enjoy almost a complete immunity. In the Upper Engadine, goitre and cretinism are little seen. The low plain country on the one hand, and the opener plains of the most elevated districts on the other, although not exempt, suffer less than do the narrow valleys of the middle zone.

EUROPE.

DIVISION III.

SOUTHERN EUROPE.

CHAPTER XVI.

SPAIN AND PORTUGAL.

GEOGRAPHY.—The Iberian Peninsula, comprising the kingdoms of Spain and Portugal, is bounded by the Pyrenees and the Bay of Biscay on the north, by the Mediterranean on the south and east, and by the Atlantic on the west. The combined area of the two kingdoms is 225,611 square miles. The central part is an immense plateau rising to the height of from 2000 to 3000 feet above the sea-level, and occupying nearly half the area of the country. This plateau is bounded and intersected by different ranges of mountains, which give rise to the numerous rivers which flow into the Atlantic and Mediterranean.

As the watershed between the Mediterranean and the Atlantic is placed to the east, the most important rivers, those having the longest course and the largest volume of water, flow into the Atlantic. Of these we may mention the Minho, the Douro, the Tagus, the Guadiana, and the Guadalquivir. The streams running into the Bay of Biscay, arising in the Cantabrian Mountains, have a short course. Of those that flow into the Mediterranean the most important are the Ebro, the Guadalaviar, the Xucar, and the Segura.

The northern region, comprising Galicia, Asturias, the Basque Provinces, Navarre, Catalonia, and the northern parts of Old Castile and Aragon, is diversified with hill and valley, and is well watered. Here the winter is cold, the spring and autumn rainy, and the summer hot.

To the south of this stretch the southern districts of Old Castile and Aragon, which, with New Castile, Leon, and Estremadura, form the greater part of the central plateau. The winter in this region is cold and the summer intensely hot. Spring and autumn are pleasant. The Mediterranean provinces of Valencia, Murcia, and Andalusia have a milder winter and a pleasant spring and autumn, but during the summer this region is exposed to the hot simoon

"levanta" blowing from Africa. In Valencia lagoons are met with along the coast. The valleys and coast lands of Portugal are fertile, but in some places, as in Setubal, in Estremadura and Aveiro, in Beira, there are salt marshes along the coast. In Portugal the rains between October and March are abundant, and the climate is tempered by the breezes from the Atlantic.

CLIMATOLOGY.—Having already noticed briefly the general characters of the climate in different regions, we shall now give the mean average temperature and the average rainfall of Alicante on the south-east coast, of Madrid in the interior, and the mean temperature of Lisbon on the west, and of Cadiz on the south-west coast:—

	Alicante.		Madrid.		Lisbon.	Cadiz.
	Mean Temperature.	Rainfall.	Mean Temperature.	Rainfall.	Temperature.	Temperature.
January,	10·76	28·4	4·90	26·1	11·4	10·78
February,	12·38	34·0	6·84	27·9	12·0	12·70
March,	13·18	41·9	9·06	33·6	13·5	12·89
April,	17·06	29·4	11·08	29·5	15·0	15·36
May,	18·40	45·9	15·04	40·1	17·6	17·64
June,	22·02	16·9	20·74	29·2	20·8	20·90
July,	25·28	12·3	24·61	6·0	22·3	21·26
August,	26·06	12·8	24·72	12·5	21·8	22·70
September,	23·88	58·4	19·84	25·9	20·8	21·21
October,	19·62	76·6	13·92	47·5	17·0	19·50
November,	14·68	34·4	8·30	44·1	13·0	14·89
December,	11·46	36·6	6·28	41·8	10·8	11·99
	17·90	427·6	13·78	364·2	16·33	16·82

The coast of Portugal has a larger rainfall than most parts of the Peninsula. At Coimbra it is said to reach 894 mm.; at Bilbao it is still higher, 1192 mm.; and at Santiago, 1759 mm.

At Lisbon the annual rainfall is 610 mm. The greatest rainfall on the Atlantic coast is from October to March. The summer season is dry.

VITAL STATISTICS.—The average marriage-rate in Spain for the seven years ending 1884 was 12·9; the birth-rate, 36·6; and the death-rate, 31·0, per 1000.

In Portugal the marriage-rate was 14·6 in 1886 and 1887; the birth-rate, 35·0; and the death-rate, 23·4, per 1000. On the eastern coasts, and in the south and east of the central region of the Peninsula, the maximum mortality occurs in summer and autumn; on the western coast, winter and autumn are the most fatal seasons. In the north and west of the central region, the mortality is sometimes hivernal and sometimes autumnal. Spring and winter are the most healthy seasons along the Mediterranean. In the central region, spring is the healthy season.

PATHOLOGY.—*Malaria* is widely diffused over the Peninsula. It is known to occur on what have been called "the bare rocky or

dry coasts" of Asturias and Galicia (Hirsch, Lombard, and Rey). Asturias, however, contains many rich and fertile valleys, with a humid climate and a high summer temperature. Galicia, again, has a heavy rainfall, possesses numerous rivers, forming estuaries at their mouths, with rich meadow-land and dense forests. Altogether these two provinces must furnish many not unlikely spots for the production of these fevers. The description of bare, rocky, and dry applied to them is misleading. The province of Minho is generally remarkably healthy. To the south the salt marshes of Aveiro and Setubal and the banks of the Mondego are seats of endemic malaria.

Fever prevails extensively in the basin of the Tagus north of Lisbon up to Santarem, the population along its banks frequently showing signs of the malarial cachexia, although the city itself is not malarious. Ferguson states that the Tagus here separates a healthy from a very unhealthy region. On the one side of the river is a bare hilly country with free open watercourses among the hills. This is the healthy side. But the Alemtejo land on the other side, though dry superficially, contains water at small depths, and being perfectly flat and sandy, is pestiferous. To sleep a night in this locality would be to run the risk of being seized with remittent fever.[1] Salvaterra, on the left bank of the Tagus, about a mile from the river, becomes so unhealthy in autumn that "every person who has the means of making his escape flies the place."

The south-west of Alemtejo is a dry country covered with heath broken by marshy wastes, but to the east the country is fertile and wooded. The marshy districts of the province are said to be affected with fever of a grave form. The banks of the Sado are also unhealthy. Algarve is said not to be exempt from malaria, which attains considerable intensity along the banks of the Guadiana. It was on the banks of this river, after the battle of Talavera in 1809, and when the Guadiana itself presented the appearance of lines of detached pools rather than a river, that the British troops, during their retreat along its course, suffered so severely from remittent fevers of a malignant character.

The lower course of the Guadalquivir flows through a flat alluvial swampy region almost uninhabitable from malaria; Seville, situated at a considerable distance from its mouth, on low ground subject to inundations, suffers from summer and autumnal fevers (Francis).

Gibraltar consists of a grey limestone rock with many cavities filled with reddish clay. An absorbent red earth forms the subsoil.

[1] Ferguson, "On the Nature and History of the Marsh Poison," *Edinb. Royal Society's Trans.* vol. ix. p. 277.

The mean annual temperature is 64°·1 F., hottest month (August) 76°·6 F., the coldest month (Jan. or Feb.) 53°·77 F. Rainfall, 32·8 inches (Parkes). Paroxysmal fevers contracted on the Rock are certainly rare, and it has even been doubted if such cases occur; although it is right to add that Dr. Maclean's observations do not support this view. He states that invalids from Gibraltar are often admitted at Netley with malarial fevers who have never served in any other station.[1] Such cases cannot, however, be numerous, as during the eight years 1859–66 the admissions per 1000 for paroxysmal fevers were only 5·3, and the deaths ·09. In 1880 the admissions were 2·5 per 1000, and no deaths; but in 1879, owing to the presence of troops from Cyprus, paroxysmal fevers gave 292·3 admissions, and 3·32 deaths per 1000. In 1888 there were no admissions or deaths from malarial fevers in Gibraltar, and the ratios for 1886–87 were 2·8 admissions and no deaths.

It is probable that cases of that special form of fever now spoken of as Gibraltar Fever, Rock Fever, Malta Fever, or febris complicata, were formerly returned as paroxysmal. This is a fever of long duration, often begins with rigors, is remittent in form, the temperature rising at night and falling in the morning, attended with copious and exhausting night-sweats, and accompanied with digestive, locomotor, genito-urinary, hæmorrhagic, and other complications—rheumatism being one of the most common of these. This fever will be noticed afterwards.

The Mediterranean coast of Spain is in some places severely affected with fever. Valencia, with its vast evaporating surface of rice grounds, and with the lake of Albufera to the south, suffers much from ague, remittent and pernicious fevers. The population is miserably cachectic. Families in the unhealthy localities die out, and the dead are replaced by strangers.[2] Entire villages have disappeared from this swamp.

At Malaga, malarious affections form about a third or a fourth of the admissions into hospital, but they are of a milder character.

Granada in Andalusia, though situated at an altitude of about 2000 feet, is also subject to fevers.

When we ascend to the central parts of the plateau, we still find ague endemic in every province. In this region it does not so often take on the remittent form, nor assume so grave a character as along the coast; yet this plateau has on more than one occasion proved very fatal to the British troops during the Peninsula War.

Malarial fevers are met with at Ciudad Rodrigo and Badajoz.

[1] *Pract.* January 1885.

[2] Cazenave, *Anno clinico de Cirurgia*, 1848, quoted by Lombard.

In the former locality the British troops suffered severe losses from fever; at the latter, the Spanish garrisons have been decimated by pernicious fevers. Merida, to the east of Badajoz, is also malarious. Coria, on the banks of the Alagon, has suffered severely from fever from ancient times. Ferguson states that the canons and ecclesiastics had a dispensation for five months' leave during the summer and autumn on account of fever. During autumn all are affected, and few old men are to be met with. In Madrid, ague is far from rare; thirty-eight deaths were registered from it from February to December 1888. It is most fatal in June and July, and again in September. During the construction of the railway from Madrid to the Escurial in 1863, an epidemic of intermittent fever broke out on that part of the line from Torrelodones to the Escurial in the midst of arid mountains; but it would appear that the epidemic began after or during the rainy season.[1] In Pamplona, again, in the extreme north, fever appears to be endemic.[2]

In the absence of sufficient information, it is impossible to say what, if any, parts of the interior are free from the disease, and what districts suffer least or most. Nor have we the means of pointing out the conditions, nor even the months in which the disease is most prevalent in different districts. As a rule, it appears to be most common in the end of summer and autumn. This, as we have seen, is the case in Madrid and Coria; but whether this holds good for all the central provinces I am unable to say. Hirsch points to the presence of malaria on what he calls "the bald, arid, and sterile table-land of New Castile, one of the most rainless steppes in Europe, whose scanty cultivation is kept up by artificial irrigation," as an instance of malaria occurring in dry places; yet, on the other hand, it must be remembered that plateaux are very favourable to the stagnation of water in the soil. There being little outflow, the rainfall does not run off so readily as in other regions, and this may help to account for the frequency with which malaria is observed on table-lands. The very existence of irrigation on level ground, rendered necessary by the scanty rainfall, is itself favourable to the development of fever. So that while the great plateau of Spain is truly a dry and bare steppe, we must not assume that malarial fever arises here on dry, well-drained soils. It may be that here, as in many other localities which may justly be called dry, malaria is in direct relation to the amount of stagnant water in the subsoil. Upon this, as upon many other points relating to Spain, the information is utterly inadequate to justify any definite conclusion.

[1] Meunier, *Compte-rendu d'une mission médicale*, Paris 1863.

[2] Briant, quoted by Lombard.

Local conditions often explain the endemicity of malaria in some elevated regions, the general characters of which seem little favourable to the prevalence of the disease. Dr. Vieta, referring to the town of Azagra in Navarre, says: "The situation of the town is damp and low, being surrounded by the rivers Ebro and Ega, and was formerly liable to periodic submersion from their overflow. Intermittent fever in its worst forms was prevalent, but it has almost disappeared since the embanking of the river and the paving of the streets. He adds, that since the fever has abated, phthisis has become more prevalent."[1]

Malarial fever was epidemic in Portugal from 1849 to 1853, and from 1858 to 1860. In 1852 the epidemy extended to all the provinces.

Febris Complicata (*Rock Fever*, *Malta Fever*, *Neapolitan Fever*, the *Country Fever* of Constantinople, the *New Fever* of Crete).—This fever is not peculiar to Gibraltar, but, as the names given above imply, is met with at various points along the Mediterranean. Its precise area of diffusion cannot be stated; and, up to the present time, its nature is a matter of dispute. Some observers regard it as malarial, and others as a form of typhoid.[2] Without entering into any lengthened discussion of this question, I think it will be admitted that the symptoms, course, complications, and pathological lesions met with in this disease are different to a large extent from those proper to malarial or enteric fever, as we at present know them; and there thus seem to be good reasons for provisionally admitting its specific character, until bacteriological research finally pronounces on its nature.

The fever is generally ushered in by rigors, and is often preceded by *malaise*, loss of appetite, headache, and pains in the back. The fever varies greatly in severity, in different cases and even in the same case, at different periods; for one of the peculiarities of this disease is that it is exceedingly liable to relapse. The most constant complication is rheumatism. Rheumatic symptoms—pain and slight inflammation of the joints—appear at various periods during its course; and, like the fever, they may pass away and recur. Rheumatism generally occurs for the first time about a fortnight or three weeks after the commencement of the fever. Bronchitis is also a common complication of this disease. The

[1] *El Genio Medico-Quirurgico*, January 15, 1883.

[2] Turner, *Pract.* vol. xxxiii. Chartris had already described this fever under the name of Mediterranean Gastric Remittent, in the *Army Medical Report* for 1865; and mentions dozing, or delirium, as a common symptom, and pneumonia, neuralgia, nervo-rheumatism, stiffness of the joints (knee especially), orchitis, and œdema of the feet, as complications. Bruce says that it prevails at Cagliari, Catania, Smyrna, and in Tunis.

tongue is covered with a slight white fur; the bowels are constipated; the stools light-coloured; the liver torpid, and the spleen much congested and enlarged. The urine is dark-coloured, and, in severe cases, may be albuminous. The perspirations are often profuse. In the worst cases death is the result of the continuous high temperature, causing failure of the heart and congestion of the lungs.

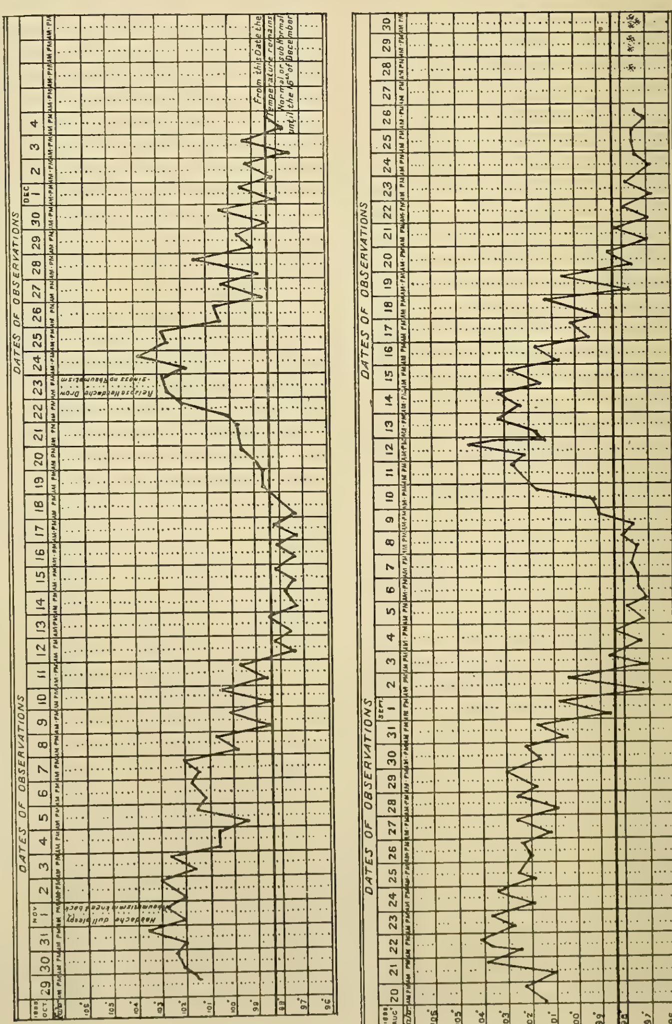
The *post mortem* appearances are, thinning of the intestines; congestion of the large intestine, especially near the ilio-cæcal valve; enlarged spleen, which may exceed four times the normal size; congestion of lungs and kidneys; liver slightly congested; brain and membranes much congested; no ulceration of the intestine.

Bruce, who has described the disease as seen in Malta, states that the average stay in hospital is eighty-five days. It is thus a very protracted fever. The fever, which often runs high, is continued, remittent, or intermittent; one case being almost purely intermittent, another almost purely remittent. The relapses, he says, are almost invariably accompanied or followed by pains of a rheumatic or neuralgic character, sometimes with swelling of the joints or orchitis. Its gravity varies greatly in different years. Out of 91 cases treated in 1886, not a single death occurred; whereas, in 1887, up to the middle of July, it had caused 9 deaths amongst the soldiers. Bruce found a micrococcus in the blood of the spleen, which he has succeeded in cultivating, and which he considers to be peculiar to the disease. It shows no signs of growth below 22° C., or above 45° C. Cases of this disease are met with throughout the year. In May a sudden rise in the number of the cases occurs; the maximum is attained in July; the disease then slowly declines in frequency till December, when it reaches its minimum. The cases are so protracted that we cannot find space to insert even a single case from beginning to end. The following chart represents very fairly the course of a severe and protracted case. The patient, a soldier, stationed at Gibraltar, was admitted to hospital on the 20th of August 1888, and was discharged on the 29th of January 1889—a period of 162 days. During this time there were four distinct relapses, separated by four periods of normal or subnormal temperature, and these were followed by a period of fever, of an irregular remittent type, lasting for another month. The last period, during which the patient had another attack of rheumatism in both knees and in the left ankle, is not represented in the chart. The first febrile attack, it will be observed, lasted about eleven days, and was followed by a period of decline lasting three days, during which the thermometric fluctuations were very marked. The first relapse lasted eight days, and was

followed by two days of marked rise and fall in temperature. The third relapse lasted about ten days, and was followed by three days of intermittent fever. The fourth lasted about eight or nine days, and terminated as usual in a few days of intermittent fever. While the course of the fever and its relapses are uniform, the periods of intermission are very variable. No doubt there are genuine cases of the disease in which no relapses occur; but these are with difficulty distinguished from other forms of fever, unless they happen to be accompanied by some of the complications peculiar to, or, at least, unusually common in this complaint.

CHART OF THE TEMPERATURE IN FEBRIS COMPLICATA (ROCK, OR MALTA FEVER).

Sapper B., age 21. Admitted, August 20, 1888; discharged, January 29, 1889.



Typhoid and *Typhus Fevers*, according to Raseri, cause an average mortality of 8·35 per 10,000 in the principal towns of Spain, and of 5·63 in the country. At Madrid, on a population of 397,816, the deaths from typhus and typhoid fever in 1888 numbered 235, which gives a proportion of 5·9 per 10,000; and this was the lowest mortality from the disease registered for a considerable number of years. The average number of deaths ascribed to typhoid fever in the capital during the six years 1880–85 was 448, which gives the excessive death-rate of 11 or 12 per 10,000.[1] I have met with no general statistics respecting the prevalence of these diseases in Portugal, but the average typhoid death-rate in the Portuguese army, for the eight years ending 1881, was 1·1 per 1000, and in Lisbon, in 1884, it was 4·02 per 10,000 living.

Typhoid fever is far from rare in Gibraltar; the admission and death-rates among the troops, for the seven years 1882–88, having been 9·1 and 1·84 per 1000 respectively. For 1871–76, Kerr Innes gives the admissions at 4·04, and the deaths at 0·89; while for the same period the admissions and death-rates for the troops stationed in the United Kingdom were 0·99 and 0·24 per 1000.[2] Mackinnon is of opinion that most of the fevers which prevail in Gibraltar are due to blood-poisoning from the respiration of an atmosphere charged with exhalations of organic matter in a state of fermentation or decomposition; for he has observed that in houses and barracks in which the drains are in a proper condition and their connection with the main sewers formed on sound principles, these diseases do not occur.[3] Enteric fever is most frequent in the hot and dry months from May to September.

Typhus Fever does not appear to be frequently met with in the Peninsula. It is included in the returns with typhoid fever.

Yellow Fever.—The Iberian Peninsula is the only region in Europe to which yellow fever has extended its epidemic range. Hirsch notices six epidemic outbreaks of this pestilence in Spain during the eighteenth century, five of which were confined to the town of Cadiz. During the present century it has extended not only over the Mediterranean coast provinces and Gibraltar, but has penetrated to Cordova, and "thereafter deep into the interior, and from Andalusia to the sea-board of Murcia, Valencia, and Catalonia," attaining elevations of 1000 feet. The Atlantic coast of Portugal has not entirely escaped these visitations, but here the outbreaks have been more limited as well as less frequent. In 1878, yellow fever was carried by the troops from Cuba to Madrid,

[1] *Boletin de Sanidad*, Madrid 1888. [2] *Army Medical Report*, 1878. [3] *Ib.*, 1888.

at an altitude of 2000 feet, where "50 cases occurred, of which 30 were fatal" (Hirsch).

Croup and *Diphtheria* are excessively prevalent and fatal—the average death-rate being 11·83 in the towns of Spain per 10,000. Madrid has a high death-rate from croup and diphtheria. The deaths averaged 844 during the eight years ending 1887. Assuming the mean population, included in the returns, to have been 397,816, we shall have the enormous death-rate from this cause of 21 per 10,000. Without claiming any great accuracy for these figures, we may safely conclude that diphtheria is at the present day excessively fatal in Madrid, and widely prevalent throughout the Peninsula.

Hirsch shows that Spain suffered severely from epidemies of diphtheria in the sixteenth, seventeenth, and eighteenth centuries.

In the year 1887, the months of October, November, and December were those in which the disease proved most fatal in Madrid.

Dysentery and *Diarrhœa,* including cholera nostras and the cholera of children, are common complaints throughout the Peninsula, becoming more fatal as we advance southwards.[1] The deaths registered in Madrid from dysentery in 1888 are given as 11, and these were chiefly confined to the summer months, during which diarrhœal diseases are also most prevalent.

Smallpox causes an average death-rate of 13·07 per 10,000 in the principal towns. A very severe epidemy raged in Madrid from August to December 1890, carrying off, according to official returns, no fewer than 2590 victims. As an explanation of this high mortality, it is stated that the lower classes are much opposed to vaccination.

Measles gives rise to a death-rate of 11·44 per 10,000 in the large towns; while *Scarlatina,* on the other hand, gives rise to the low death-rate of 1·46 per 10,000 in the towns.

Asiatic Cholera made its first appearance in the Peninsula in 1833, breaking out at Oporto, into which it is supposed to have been introduced in January of that year by an English vessel. From this point it spread to Coimbra, Aveiro, and Lisbon. In the middle of the same month it appeared at Vigo, the principal seaport of Galicia, from whence it spread southwards, extending through the whole of Spain, during this and the following year. Spain and Portugal escaped in 1848, when the disease overran the greater part of Europe; but they suffered severely during the period

[1] Diarrhœal diseases (1880, 1881, 1884) gave rise to a death-rate of 2917 per million at Madrid, and of 2104, in 1881, at Barcelona.

1853–60, when cholera was once more introduced through the port of Vigo, as in 1833. In 1865 the disease was introduced from Marseilles into Valencia, and into Gibraltar from Malta, spreading to most parts of Spain and to a few spots in Portugal. Another severe epidemy broke out in the years 1884–86; the deaths in 1885 were officially stated to number 119,620. In Valencia alone, the deaths from cholera numbered 21,613. Cholera disappeared from Spain in the beginning of 1886, and the country remained free from the disease until the 13th of May 1890, when it appeared at the village of Puebla de Rugat in the province of Valencia, coincidently with the excavation of a considerable amount of drain-sodden earth in the village.[1] From this point it spread gradually into the interior, causing a considerable mortality. In this instance there is no evidence whatever of the disease having been introduced from without, as on all previous occasions. We must therefore conclude that it either originated *de novo* at this village, a very unlikely assumption, or that its cause had remained latent for the space of five years, which would be a fact of special importance in relation to the etiology of the disease.

Influenza has generally extended to the Peninsula when it has been epidemic in neighbouring countries, but its outbreaks there have exhibited no peculiarities that require notice.

Whooping-Cough is only moderately prevalent, the death-rate from this disease being 2·68 per 10,000 in the towns, and 3·14 in the country,—ratios about half of those which obtain in England.

Bronchitis and *Pneumonia* are amongst the common and fatal diseases in Spain, together giving rise to a death-rate of 53 per 10,000 in the principal towns. The deaths in Madrid from these two diseases in 1888 numbered about 3100, which is equivalent to a ratio of 77·0 per 10,000 living—the ratio from bronchitis being 48 per 10,000, and that from pneumonia 29 per 10,000. The table-land suffers more than the coast line, the north than the south, and the towns than the country districts, from acute respiratory affections. At Gibraltar these complaints are by no means frequent, giving for 1879–84 an average admission-rate of 34·9, and a death-rate of 0·69, per 1000.

Pleurisy is a fatal disease on the high lands of the interior. The death-rate from this cause in Madrid, in the year 1888, reached 120 per million.

Bronchitis and pneumonia are at the minimum from June to September; the former attains its maximum in December and January; the latter, in February and March.

[1] *Lancet*, 21st June 1890.

Phthisis is very common in the large centres of population, but less so in the country districts. The higher altitudes of the table-land enjoy no immunity from the disease. The disease is less frequent at Malaga and Valencia. The ratio of admissions and deaths per 1000 in the force stationed at Gibraltar for the period 1879–84, was 4·9 and 0·98 respectively, while 2·48 per 1000 were invalided home. These figures show that Gibraltar suffers only moderately from consumption.

Acute Rheumatism is reported to be common throughout the Peninsula; but I have no data from which to deduce its actual prevalence or fatality in the country generally, or its relative prevalence in different regions. Lombard states that the mortality from rheumatism at Lisbon is higher than at Copenhagen, Brussels, Glasgow, or Edinburgh, but less than at Bordeaux or at London. He further states that rheumatism is endemic on the plateau of Castile and in Asturias, and that it is also frequently met with in Seville, Granada, Valencia, and Malaga. The rate of admissions from rheumatism in Gibraltar averages about 39·7 per 1000, which is somewhat less than that of the troops stationed in the United Kingdom. The proportion of cases of rheumatic fever to the total of rheumatic affections appears to be less than in England. At Gibraltar rheumatism is a frequent complication of Rock Fever.

Hepatitis is frequently met with in the south of Spain, and abscess of the liver is by no means rare.

Scrofula is prevalent both in Spain and Portugal, especially in the larger towns, both on the coasts or on the table-land.

Anæmia, whether due to malaria, insufficient nourishment, or to other causes, is common in Spain. In Madrid, in 1888, the deaths ascribed to anæmia were in the ratio of 4·1 per 10,000 living.

Syphilis.—We have no exact data as to the prevalence of syphilis in the Peninsula as a whole. The British troops during the Napoleonic wars suffered from a malignant form of the disease, popularly known as the "black lion;" but at the present day, according to Jullien, Portugal is less severely affected.[1] In Spain, on the other hand, venereal complaints must be common and severe. In 1850, according to Mollindeo, out of 11,527 soldiers attacked with these complaints who entered the Spanish hospitals, 79 died. The disease is said by Cazenave to be excessively common in Malaga.

At Gibraltar primary and secondary syphilis cause fewer admissions than at home.

[1] Jullien, "Étude sur la distrib. geograph. de syphilis," *Archiv de méd. nav.* vol. xxx.

Leprosy is met with in Galicia, Asturias, Catalonia, Granada, and Andalusia, although the exact number in the various provinces is uncertain. The latest accounts give the number of lepers in Seville as 30 to 35. Cazenave found 61 patients in the leper hospital of Granada about thirty years ago. In 1877 the number of lepers officially reported in Valencia was 116, but numbers escaped notice. Leper centres also exist in other places bordering upon the Mediterranean, such as Malaga and Alicante. In Portugal leprosy still survives in the district of Lafoës, in Beira, and in the province of Algarve.

Goitre and *Cretinism* are endemic in the valleys of the Pyrenees and of the Cantabrian mountains, as well as in the mountainous districts of Estremadura and New Castile.

Pellagra, known as the Mal de la Rosa, prevails in the neighbourhood of Oviedo in Asturias, where it is attributed to the use of maize of bad quality ; but it is also met with to a small extent in many other districts of Spain.

The Balearic Islands—Iviça, Formentera, Majorca, Minorca, and Cabrera—lie off the east coast of Spain. Majorca, the largest of the group, is 64 miles long by 48 broad, with an area of 1386 square miles. The north-east is mountainous ; the other parts consist of plains and valleys. The inhabitants number about 200,000. The capital is Palma. Minorca is 31 miles long by 13 broad, with a population of 37,000. The capital is Port Mahon. The country is undulating, and indented by deep bays.

A very complete and interesting account of the diseases of Minorca was written about the middle of last century by Cleghorn.[1] He mentions that " tertian fevers of various forms begin in June, and increase daily in frequency till the autumnal equinox, when they rage with the utmost fury ; then they gradually decline, and die out as winter approaches." He notes that " in 1741 there were heavy rains towards the end of May and the beginning of June. Scarcely had June ended when tertian fevers began, and increased daily until September, when they attained their greatest degree of frequency, and then gradually declined." He observes also that " cholera morbus " sometimes has its regular periods like a tertian ague ; that tertians are frequently associated with a cholera morbus, and that a dysentery may be converted into a tertian or *vice versa*.

Majorca is also severely affected by malaria. Typhoid fever is common. Yellow fever was introduced into Palma from Barcelona in 1804, and again in 1821.

[1] *Observations on the Epidemical Diseases of Minorca*, London 1768.

CHAPTER XVII.

ITALY.

Geography.—Italy consists of a peninsular and an insular portion. Along with the latter I shall include the islands of Corsica and Malta, although they do not politically form parts of the kingdom.

The peninsular part of Italy is bounded on the north by the Alps, and extends south-eastward, in the form of a boot, for 700 miles to the Strait of Otranto. It is washed by the Adriatic on the east, and by the Tyrrhenian Sea on the west. The heel of the boot is turned towards Greece, and the toe points to Sicily and Africa. The Italian kingdom, with an area of 110,657 square miles, is divided into sixteen departments,—the population being, in 1887, 30,101,103. Rome, the capital, in 1887 had a population of 382,973. Turin had 294,826, Naples about 481,000, and Venice 150,502 inhabitants in that year.

The physical configuration of Italy is to a great extent determined by the Apennine range. The Apennines are a continuation of the Alpine system, which forms the northern boundary of Italy. This range, under the names of the Graian, Cottian, and Maritime Alps, separates Piedmont from France on the north-west; and then, as the Ligurian Alps, it skirts the Gulf of Genoa. Under the name of Apennines the range now strikes obliquely across the peninsula from north-west to south-east, forming the southern boundary of the Po valley; then, turning southwards, it follows the axis of the peninsula, giving off numerous spurs and secondary ranges towards either coast. Arriving at the southern extremity of the peninsula, it projects a spur into the Apulian heel, while the main ridge, changing its direction to south-west, traverses Calabria through its entire extent. Its continuation can be distinctly traced through Sicily from the neighbourhood of Messina in a more or less westerly direction across the entire island, but keeping much nearer to the northern than to the south-western coast.

The Apennines thus cut off the great valley of the Po from the rest of the peninsula. Their longitudinal ridges and spurs form a central region of various elevations and possessing a varying climate, which is, upon the whole, a healthy one, leaving a coast margin, in some places narrow, in others widening out into great plains and fertile valleys—the salubrity of which, as we shall see, varies very much in different parts.

Rivers.—The most important river in Italy is the Po. Rising in the Cottian Alps, it flows eastward into the Gulf of Venice. It receives the Tanaro from the Ligurian Alps. The Ticino, the Adda, the Oglio, the Mincio, and numerous smaller streams from the Helvetian and Rhætian Alps, join it from the north. The Trebbia, Taro, Parma, and Secchia, from the Apennines, fall into it on the right. It begins to form its delta about fifty miles from its mouth, —the principal branches of which are the *Po della Maestra*, on the north, and the *Po di Primaro*, on the south.

The Tagliamento, the Piave, the Brenta, and the Adige flow into the Gulf of Venice. The rivers of the southern part of the peninsula, running transversely from the central ranges of the Apennines towards either coast, are comparatively short and liable to overflow. The more important of these are the Tiber, in the Roman territory; the Arno and the Ombrone, in Tuscany; and the Garigliano and the Volturno, in Campania (Naples). Numerous small rivers and streams, of which we may mention the Pescara, the Sangra, and the Ofanto, fall into the Adriatic.

The *lakes* of any considerable size are the Maggiore, Lugano, Como, Iseo, and Garda, in the north; and Perugia, Bolseno, Bracciano, and Celano, now drained, in the south.

Of the great *plains* the most important is the valley of the Po. This valley has a length of 250 miles from west to east, and a breadth of about 50 miles, with an irrigated area of 5000 square miles. On the Mediterranean coast a series of low-lying districts stretch through Tuscany down to the Neapolitan frontier, comprising the Maremma, the Roman Campagna, and the Pontine marshes. The plain of Naples, which, but for Vesuvius, is "free from inequalities that would serve to conceal a sheep, runs in upon the Apennines like a sea upon a rocky coast." On the south, along the Gulf of Tarento, we have the plains of Basilicata, 100 miles long by about 24 miles broad. The plain of Apulia stretches down towards Otranto, while narrower tracts of level land, watered by numerous streams, extend along the eastern coast.

Hitherto we have chiefly met with malarious diseases in connection with marshy lands, moist banks, and deltas of rivers, or

with artificial marshes, such as the étangs of Sologne and Bresse. Along the west coast of Italy malaria of an intense kind is met with on soils which have none of the usual characters of a marsh. As the Roman Campagna is a typical instance of a malaria-producing plain, it may be well to interrupt for a moment our description of the physical features of the country in order to give a short account of a region respecting which so much has been written, and which counts for so much in all controversies about the nature of malaria.

I shall follow the description of Colin, who, as he informs us, went carefully over the Campagna in order to satisfy himself respecting its physical characters. This plain is furrowed over throughout its entire extent with undulations so slight that one can seize all the details of this great basin and its periphery from the smallest elevation, either in Rome itself or its environs, or from Tivoli, Frascati, or Albano. This appearance of flatness is increased by the absence of habitations or high vegetation in the Campagna. The few oases, and the few miserable houses that do exist, scarcely attract notice. Nothing whatever of the nature of marshy grounds or even of stagnant pools is met with. From the month of June, when the rains cease, the soil is characterised by its extreme dryness. It cracks and opens under the high temperature of the summer. Nor is the Campagna subject to inundations (except in isolated spots), which might help to explain its insalubrity. The soil is constituted superficially of a porous volcanic tuff, which rests upon an impermeable layer of sub-apennine marl, extending from one extremity of the Roman plain to the other.

The numerous slight undulations or hollows in a flat expanse on the one hand, and a porous soil with an impermeable subsoil on the other, are conditions favouring at once the rapid disappearance of the rainfall from the surface and its accumulation and retention in the subsoil. In the same way the water percolating from the Apennines finds no ready exit to the sea, and much of it, instead of draining off, lodges in the hollows of the plain, and is gradually dissipated by evaporation.

In spring and autumn the Campagna is covered with rich verdure; but during the months of June, July, and August the natural vegetation disappears under the combined influence of drought and heat.

That the soil of the Campagna is naturally fertile, may be inferred from the fact that in olden times it was the seat of a dense population, and was regarded as the granary of Rome.

The Maremma of Tuscany may be regarded as the continuation

northwards, of the Campagna. The whole of this tract is eminently malarious, especially the commune of Grosseto.

The accounts given by authors of the physical features of the Maremma are so entirely contradictory, that I have obtained a full description of Grosseto from a competent authority on the spot, which I shall here give in full.

The Commune of Grosseto.

"1. The town is situated on an open plain, about 10 kilomètres from the sea, and about 12·4 (mètres ?) above its level.

"2. During the summer, especially, it has great and trying variations of temperature. The average annual temperature during 1875–84 was 14°·5 C.; the highest, 37°·4; and the lowest, 6°. Fogs sometimes exist during the morning hours in summer; snow falls rarely—every six or seven years; rain is comparatively rare. During 1875–84 it reached a medium of 654·10 mm. during ninety-eight rainy days. Strong winds are frequent from the N. and S.S.W.; during the summer they generally blow from the S.W.; in winter from the S.E. and N.E. Every year hail falls, but does not do much harm to the country.

"3. The river Ombrone, and the streams Salica, Rispecia, and Grillese, pass through the commune. The first is about a kilomètre distant from the town, varies very much in its level, and is often the cause of inundations. The streams often become dry in summer. They drive mills for grinding corn, and, along with two large canals from the Ombrone, help to raise the level of the marsh Castiglion della Pescaia.

"4. The marshes which merit special notice are Castiglion della Pescaia, 4000 elt. in extent; Alberese, 300 elt.; Trappola, 500 elt.; Paludine, 600 elt. They are almost all of fresh water, and at some distance from habitations. They become dry in summer, and exhale very dangerous vapours. Some are being dried by means of filling them up, and other methods are now under consideration.

"5. Water is of good quality, but scarce during the summer. It is in part procured from cisterns (six public, and sixty-four private), and in part from the stream Marano, and is brought to the city from a distance of 15 kil. in terra cotta tubes, the interiors of which are varnished. The fountains are in the piazza and streets, the cisterns in the courtyards of the houses.

"6. There are hot springs at Roselle, where there is a bathing establishment that dates from the time of the Romans. The water

contains sulphate, carbonate, and muriate of lime, magnesia, and soda (grammes ·169 per litre).

"7. The woods are almost entirely destroyed. Near the sea, to the S.W. of the town, there is a pine wood about 15 kil. in length and 1 kil. in breadth. There are no fenced fields. Neither rice nor flax is cultivated, and the cultivation of the silkworm is very limited.

"8. Agriculture and the raising of sheep and cattle are the principal employments. There are two important foundries for the manufacture of agricultural implements, and an oil mill for the extraction of oil from olive husks by means of sulphurate of carbon. Here 123 men and 6 boys are employed.

"9. The town is surrounded by walls. The streets are wide, straight, even, and paved with sandstone. The principal ones have sewers, into which water from the Ombrone is almost continually poured. The cleaning of the streets is let out by contract. The refuse is generally carried to a sufficient distance from human dwellings. There is only one house which has more than three floors. The number and size of the houses are sufficient for the inhabitants.

"10. The labouring classes and those engaged in tilling the ground live chiefly on bread made of wheat or Indian corn. A considerable quantity of beef, pork, and mutton is also consumed, but very little salted meat or fish. There is one public slaughter-house, which is visited by an inspector; the people, however, prefer to kill their animals in the country, where there is no examination.

"11. There are two cemeteries for the city, the one 1 kil. and the other 800 m. distant. There are other two for the frazioni of Bastignano and Istia, distant respectively 150 and 300 m. from these villages. Each grave is separate, but all the corpses are not enclosed in coffins. At all the cemeteries there are mortuary chapels. The communal doctors make the *post mortem* examinations.

"12. There are three druggists' shops, six doctors, five dentists, three midwives, four veterinary surgeons—three of whom are in Government service. The commune pays one doctor and one veterinary surgeon.

"13. The number of children vaccinated from 1880–84 was 481. Re-vaccination is not practised.

"14. Cases of malarial fever are very frequent; those of scurf, scab, and diseases of the eyes are but rare. Pleuro-pneumonia and rheumatism are common; but consumption, heart disease, and inflammation of the bowels seldom occur; tape-worm is very rare,

and pellagra is unknown. Cholera has never visited the commune. For twenty years there has been no plague amongst the cattle.

"15. There is a private infant asylum, which, up to the end of 1884, had received 133 inmates. The place is large and well ventilated.

"16. There is a private hospital for both sexes, supported by the congregation of Charity. It has 160 beds, and in January 1884 there were 50 patients (average number during five years, 57)."

The Maremma thus appears to differ from the Campagna in being traversed by a greater number of streams, several of which are liable to overflow, by the existence of numerous true marshes of considerable extent, and, so far as one can judge, by a wider extension of cultivation; but malaria in the Maremma is by no means confined to the marshy localities.

Returning to our survey of the physical features of the country, we shall now notice the *marshes* of the peninsula. Leaving out of view the extensive rice fields of the Po valley, we meet with large tracts of marsh and lagoon along the shores of the Gulf of Venice, in the delta of the Po, stretching through Comacchio and Ravenna to Rimini. In the Grosseto commune of the Maremma are the marshy tracts already mentioned in detail. An area of about 1500 hectares of marsh is to be found at Macarèse, Porto, and Ostia, near the mouth of the Tiber. In the south of the Campagna are the Pontine Marshes, occupying an area of about 25 miles long by 14 broad. On Neapolitan territory (Campania), marshy spots exist near Salerno, with its rice fields, and at Caserta and Capua. Marshes of greater or lesser extent are met with in some parts of Calabria, in Basilicata, and in Apulia, especially along the Gulf of Manfredonia. Indeed, from Manfredonia to the mouth of the Ofanto, the coast is fringed with marshes, lagoons, and salt lakes. To the north are the lakes of Lesina and the inundated plains of Abruzzo.

SICILY is separated from the mainland by the Strait of Messina. It has an area of 10,000 square miles, and a population of about two and a half millions. One of the spurs or secondary ranges given off from the central mountain range, which we have already mentioned, encloses the valley of Catania in the east, through which the Simeto flows. Another spur from the central range, running southwards, marks off the valleys of the Salso and Platani. The only lake of any importance in Sicily is the Lentini, at some distance from the coast, between Catania and Syracuse.

The plains, which are of great fertility, are those of Catania, Palermo, Castellamare, Licata, and Terranova. Lombard gives the area of marsh and submerged lands in Sicily as 62,833 hectares,

out of a total of 2,924,124 hectares. If this estimate is correct, marshy grounds abound in the island. The southern coast is the most swampy. Irvine mentions that the beds of rivers and streams in Sicily often become dry in summer, but that a certain amount of water continues to pursue its way underneath the surface. These river beds are called *fiumari*, and are somewhat of the nature of marshes.[1]

Sardinia, situated in the Mediterranean, to the south of Corsica, is 166 miles long by 90 miles broad. Its area is about 9000 square miles, with a population of 700,000. The capital is Cagliari. The island is divided into two provinces—Cagliari and Sassari. The country is mountainous, but between the ranges there are many fertile valleys. Along the southern and western coasts are some plains of great fertility, but in many localities the low lands are marshy. Lombard gives the area of marsh and submerged lands in the province of Cagliari as 22,000 hectares. From Oristani north to Cape Mannu there are numerous lagoons. A large salt lagoon lies to the west of the city of Cagliari. In the province of Sassari the area of marshy land is given at 8000 hectares only.

Corsica forms a department of France. It extends 100 miles from north to south, and has a breadth of about 50 miles. Its area is 3340 square miles, with a population of 260,000. The island is traversed in the direction of its length by mountains, the highest of which reach an altitude of 9068 feet, covered with perpetual snow. On the west side of the island the mountains reach the sea; on the east side alluvial plains stretch between the mountains and the coast. These are edged with lagoons, and present numerous swampy tracts. The plains are in many parts covered with bush or brushwood, called *makis* or *macchie*; others are of great fertility. The chief rivers, and these of no great importance, are the Tavignano and the Golo on the east coast. Numerous mountain torrents and streams run down the ravines, but these dry up in summer. Many of them form lagoons at their mouths.

Malta.—The island of Malta is of limestone formation. It is not mountainous, rising at no part above 590 feet. It is diversified with hill and valley, well cultivated, and free from marsh.

Climatology.—The temperature and rainfall of four localities, representing the north-west of the Po valley, and the south-west coast, the north-west coast of Sicily, and the temperature of Venice, as given in the following table, will give a general idea of the climate of Italy:—

[1] *Observations on Diseases, chiefly in Sicily*, London 1810.

Average Mean Temperature and Average Rainfall of Four Representative Districts of Italy, and the Mean Temperature of Venice.

	Turin.		Rome.		Naples.		Palermo.		Venice.
	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.
January,	–0·6	36·7	6·79	83·4	8·58	77·0	11·43	84·1	1·8
February,	2·4	29·6	8·89	63·8	10·29	60·2	12·26	52·7	3·9
March,	7·0	63·5	10·51	69·7	10·74	68·7	13·31	59·6	7·9
April,	11·5	103·2	14·49	60·7	14·52	72·5	16·57	42·7	12·6
May,	16·8	106·5	17·72	53·5	17·62	51·4	19·26	22·8	17·4
June,	20·3	92·8	22·49	36·3	22·21	41·8	23·10	15·7	21·3
July,	22·7	56·5	24·84	16·8	24·55	26·6	25·91	6·0	23·9
August,	22·9	82·5	25·27	26·3	24·96	23·0	26·64	8·6	23·2
September,	18·0	64·5	21·82	63·1	21·95	60·2	24·42	44·7	19·0
October,	12·5	73·4	16·80	121·4	18·20	122·4	20·07	75·0	13·7
November,	5·9	67·9	11·80	109·2	12·97	125·7	16·22	74·9	7·0
December,	0·7	49·8	8·49	98·8	9·89	116·3	13·02	89·5	4·4
	11·7	826·9	15·82	803·0	16·37	845·8	18·52	576·3	13·1

The climate of Turin and the north of Italy is temperate; that of the south is almost tropical in summer. The prevailing north-east winds render the climate on the Adriatic coast colder than corresponding latitudes on the Mediterranean.

The hot sirocco blows over Sicily and the south of Italy, causing great depression and parching of the vegetation. This wind is most felt in summer and autumn.

The temperature at Valetta, in Malta (average of 11 years), was 66°·8 F., and the average rainfall is about 22 inches.

The rainfall at Citta-Vecchia, in the centre of the island, at an elevation of nearly 600 feet above the sea-level, is considerably greater than that of Valetta. The rainy season is from November to January.

The south-east wind, or sirocco, blows for about seventy days a year, and is the prevailing autumn wind.

VITAL STATISTICS.—The marriage, birth, and death rates of the kingdom of Italy, for the ten years ending 1887, were on an average 15·4, 37·0, and 28·1 respectively. The death-rate is thus much higher than in the countries of Northern Europe. In the north of Italy, with the exception of Liguria and Tuscany, winter and spring are the seasons of the greatest mortality. In the south, and in the two provinces just mentioned, the mortality is highest in summer, and this is also the case in Sicily. The provinces of Calabria and Basilicata forming exceptions, for in these, as in Sardinia and Malta, autumn is the most unhealthy season. The death-rate of Malta in 1886 was 27·0 per 1000.

PATHOLOGY.—*Malaria.*—Malarious diseases are more frequent in Italy than in any other part of Europe, with the exception, perhaps, of Hungary. The average malarial death-rate (1881–86) in 284 communes, all over the kingdom, comprising a population of nearly seven and a half millions, was 4·8 per 10,000 inhabitants, or 480 per million.[1] In England, which is one of the least malarious countries in Europe, the proportion is about 3 per million; in the Netherlands it is about 160 per million. These figures will show how important is the *rôle* of malaria in Italy. The deaths from malaria are in the ratio of 167·3 to 10,000 deaths from all causes.

The following table gives a general view of the intensity of malaria in the several departments of Italy:—

[1] The number of deaths ascribed to malarial fever in 1887 throughout the kingdom was 21,033, which would give a ratio of about 700 per million.

DEATHS FROM MALARIAL FEVER IN THE CHIEF PLACES OF THE PROVINCES AND DISTRICTS, DISTRIBUTED ACCORDING TO "COMPARTIMENTI." (POPULATION IN 1886, 7,440,287.) AVERAGE OF THE SIX YEARS 1881-86.[1]

COMPARTIMENTI.	Proportion of Deaths from Malarious Diseases per 10,000 Inhabitants.	Proportion of Deaths from Malarious Diseases per 10,000 of the Total Deaths.
Piedmont,	1·9	69·0
Liguria,	0·2	7·2
Lombardy,	1·2	38·3
Venice,	2·1	73·4
Emilia,	1·6	53·3
Tuscany,	1·4	52·9
Marches,	0·8	29·3
Umbria,	1·5	56·3
Latium,	13·2	490·6
Abruzzo and Molise,	8·4	297·6
Campania,	2·5	82·3
Apulia,	14·6	413·8
Basilicata,	27·5	822·2
Calabria,	20·4	663·0
Sicily,	8·4	326·1
Sardinia,	20·0	777·2

The incidence of the disease on more limited areas is shown in the following table, which also shows the annual variation of the death-rate for the four years 1883–86 :—

TABLE OF DEATHS FROM MALARIAL FEVER IN NINETEEN COMMUNES OF ABOVE 60,000 INHABITANTS, PER 10,000 OF THE POPULATION.

	1883.	1884.	1885.	1886.
Naples,	0·9	0·9	1·0	0·7
Milan,	1·2	0·9	0·6	1·0
Rome,	16·2	12·3	12·3	10·3
Palermo,	1·9	1·9	2·6	1·8
Turin,	0·8	1·1	0·3	0·1
Genoa,	0·1	0·3	0·1	0·2
Florence,	0·2	0·1	0·2	0·2
Venice,	0·9	0·9	1·1	1·0
Messina,	1·7	2·3	1·4	0·8
Bologna,	0·2	0·2	0·2	0·2
Catania,	5·0	3·8	5·1	3·3
Leghorn,	0·6	0·3	0·1	0·2
Ferrara,	7·3	5·2	6·1	8·8
Padua,	0·6	0·7	0·4	1·7
Lucca,	0·1	1·0	0·4	0·3
Verona,	0·9	0·4	1·2	0·7
Alessandria,	0·3	0·2	0·2	0·2
Bari delle Puglie,	2·1	3·0	4·2	3·2
Brescia,	1·5	0·5	1·5	0·8

[1] These averages are obtained by adding together the average for the four years 1881–84, and the death-rates per 10,000 for 1885 and 1886, and dividing the sum by three. This gives a close approximation to the true average of the six years.

We shall see how far the greater or lesser malarial mortality is regulated by latitude and by local conditions.

A glance at the former of these tables will show that malaria is, upon the whole, much more fatal in the south than in the north of Italy. The influence of the increasing temperature in augmenting the intensity of the malarious influence can scarcely be doubted. But if we compare the mortality from malarial fever in Naples and Rome, we shall be satisfied that local conditions are of still greater importance than the higher or lower temperatures of the different latitudes in determining malarial prevalence.

We shall examine a little more in detail the prevalence of malarious diseases in different parts of Italy, and their relation to local conditions of the soil, and the types they assume.

Turin is comparatively healthy, its annual death-rate from malarial fever and cachexia being 0·6 per 10,000 inhabitants.

Bertini found the types of fever in 550 cases observed in the hospital of St. Maurice and Lazzare to be in the following proportion per cent.: quotidians, 28 p.c.; tertians, 59 p.c.; quartans, 11 p.c.; and abnormal forms, 2 p.c.[1]

The southern slopes of the Alps in Piedmont, Lombardy, and Venice are either entirely healthy or suffer only slightly from malaria, which, however, is more common in the low, damp lands of the south.

Milan has a mortality from malaria about one-third above that of Turin; but the fact that the troops stationed here furnish a smaller mortality from fever than those in any other part of the kingdom, forbids us to regard the city as unhealthy. The facts indicate that some districts, such as those in which the troops are located, are nearly free from malaria, while others relatively suffer more, so as to raise the malarial death-rate above that of some of the healthier towns of Italy.

The neighbourhood of Milan to the south and west is said to be unhealthy.

Although Lombardy, as a whole, like Milan, does not appear to suffer much from malaria, the mischief is rather latent than non-existent. Witness the sufferings of the French army in Lombardy during the campaign of 1859. It was in this region that epidemic remittent fever raged to such a degree, that, according to Cazalas, it constituted almost the entire pathology of the army.[2]

This is an example of an epidemo-endemy affecting the unacclimatised. The enormous population, which is aggregated chiefly

[1] Bertini, *Seconda Statistica nosologica del V° Spedale Maggiore dei SS. Maurizio e Lazzaro*, Torino 1839 (quoted by Lombard).

[2] Cazalas, "Maladies de l'armée d'Italie," 1859–60, in the *Mémoires de méd. milit.*, t. ii., 1864.

in towns or large villages, and the careful cultivation of the soil, help to explain the comparative salubrity of this region.

Venice has only a slightly higher fever death-rate than Milan. The salubrity of this city, built as it is in a lagoon, is remarkable. Is this not owing to the fact that Venice is very much in the position of a vessel anchored out at sea? Being surrounded by water and intersected by canals, there is little soil in which malaria can grow or be evolved.

The marshes and lagoons to the north and south of the city have an evil repute. All writers concur in insisting upon their unhealthiness, but I can quote no statistics bearing upon the point. In support of the malariousness of these localities, we observe that while the city of Venice is remarkably free from malaria, as is also Verona, the fever mortality of the department of Venice is nearly double that of Lombardy, and also considerably higher than that of Piedmont. This points to the existence of malarious *foci* in certain parts of the province.

The greater intensity of the disease in Venice, as compared with Piedmont and Lombardy, will be seen not only in the greater number of deaths from malaria to the unit of population, but also in the higher proportion which deaths from malarious disease bears to the total mortality in Venice.

Ferrara, situated on a low marshy plain in the delta of the Po, and in the neighbourhood of lagoons and lands alternately dried and submerged, is highly malarious. After Rome, it is the most malarious commune of Italy included in our tables.

Emilia, according to Lombard, is the most marshy province of Italy. He calculates that one-eighth of the land is marsh. Yet we are met by the fact that the fever mortality of this province is only 1·6 per 10,000. It ranks sixth, in the scale of salubrity, amongst the sixteen departments of the kingdom. Equally favourable is the view of its position supported by the military returns, the deaths from malarial diseases being 0·28 per 1000.

The location of the chief seats of population in districts remote from paludal conditions may explain to some extent this anomaly.

Tuscany, at the present day, occupies a position, as regards salubrity, when compared with the past, which renders much that has been written concerning this department obsolete and misleading. There is, in fact, only one highly malarious district in Tuscany, viz. Grosseto in the Maremma.

The following table gives the deaths per 10,000 inhabitants in the various divisions of Tuscany, for the years 1882–84, from typhoid and malarial fevers respectively:—

	Typhoid.	Malarial Fever.
Arezzo, ...	17·4	1·8
Florence, ...	7·8	0·1
Grosseto (Maremma), ...	27·1	65·1
Leghorn, ...	12·2	0·5
Lucca, ...	10·6	0·6
Massa, ...	24·1	2·2
Pisa, ...	8·6	0·9
Sienna, ...	9·1	1·1

Florence, the capital, has one of the lowest malarial death-rates of any of the Italian towns.

Leghorn, in the same province, occupies by no means an unfavourable position in respect of health.

The northern part of Tuscany has been rendered comparatively healthy by the application of two measures, the one having for its object the removal of water stagnating in the soil, the other the prevention of the admixture of fresh and salt water in the marshes and lagoons of the littoral.

The plains of Fuceechio, Pisa, Lucca, Leghorn, and Viareggio were formerly each occupied by its lake. These lakes have now been drained. Viareggio, up to 1740, was a miserable village, avoided on account of its unhealthiness. It is now a favourite health resort.

A notable instance of the benefit to be derived from drainage and cultivation, is furnished by the change that has been effected in the Val di Chiana.

In this locality, the spurs from the Apennines, instead of descending directly towards the sea, change their direction, and become parallel ranges. So completely are the ridges in Tuscany thus separated from the main chain, that the head waters of the Arno, which passes Florence, have been connected by a navigable passage with those of the Chiana, a tributary of the Tiber, along a valley formed by these parallel ranges. Formerly the watershed between the basins of the Arno and Tiber was close to the Arno, and the greater part of the valley of the Chiana was occupied by stagnant pools extending for 20 miles to the south-east. The whole of this valley was excessively malarious. Dante spoke of it as " an accursed place." After having been drained, it has now become one of the most healthy and populous districts of Italy.

About the middle of last century, an engineer named Zendrini proposed to construct sluices to hinder the mixture of the sea and fresh water in the lagoons. This was carried out, with the result that the fever disappeared from localities previously uninhabitable. In 1768 and 1769 the sluices fell out of repair. This was at Viareggio. The result was that the malarial infection immediately

reappeared with great virulence, carrying off 170 out of a population of 1350 in the course of those two years. The disease subsided when the sluices were put in order. Twice since that date have similar results followed neglect to keep the works in proper repair.

The northern part of Tuscany has thus experienced a great amelioration in respect to health in recent times by means of the measures indicated.

The Maremma lies to the south of the district to which we have been referring. It may be said to extend from Piombino to Orbitello along the coast, and to a distance of 15 to 25 miles inland. This region is still highly malarious—perhaps the most malarious spot in Europe—notwithstanding the measures that have been taken to improve it.

The inhabitants, we are told, never reach a great age; and although they descend to the plains only when they are compelled to do so for the purpose of cultivating the soil or of reaping the harvest, they often contract fevers that impair their health or prove fatal.

During the winter the Maremma is habitable, but in the other seasons it is very unhealthy. The malarial death-rate, as we have seen, averages 65·1 per 10,000 of the population.

The principal towns in the province of Grosseto are Arcidosso, Campagnatico, Castel de Piano, Castiglione della Pescaia, Cinigiano, Gavarroano, Grosseto, Isola del Giglio, Magliano, Manciano, Massa, Marittima, Monte Argentario, Montieri. In Arcidosso it is remarked that malaria is rare, also in Monte Argentario. In the Isola del Giglio there is none. In the other districts it is very frequent, as may be seen from the above statistics.

This province has suffered from malarial epidemies at various times. That of 1842–44 was very fatal. It is estimated that about 60 per cent. of the population was attacked, and a large number died.

During the epidemy, out of 25,968 cases of intermittent fever, the various types were represented as follows:—

Quotidian, ...	18,445
Tertian, ...	5,821
Quartan, ...	807
Abnormal, ...	145
Pernicious, ...	750

It is worthy of remark that the towns of Orbitello and Piombino, although situated in the neighbourhood of swamps, are not malarious. This is ascribed to their position, which permits them to enjoy freely the sea breezes. Perhaps other circumstances connected with their sites may contribute to their immunity.

Rome, and the whole plain on which it stands, is extremely malarious. One or two regions of Italy vie with Latium as haunts of malaria; but no great town in the kingdom, or in Europe, can compare with Rome in respect to the proportion of deaths ascribed to malarial fevers, which here (1883–86) reaches the high figure of 12·8 per 10,000 of the inhabitants. The whole of the city is not equally affected by the scourge, for it has been observed that the more densely-peopled and central districts are the healthiest. Even those localities which are inhabited by the poorer classes, such as the Ghetto or Jewish quarter (no longer existing), noted for want of ventilation, the great overcrowding of the population, and the filthy condition of the streets, are less malarious than many other districts, the general condition of which appears in every way superior. "The less densely-peopled suburbs, where the houses are few, well built, surrounded by gardens, and apparently answering the conditions required for perfect salubrity, are extremely unhealthy" (Colin).

The tertian type of fever is that which is most common amongst the civil population. The French soldiers on their arrival were attacked, during the first years of their sojourn, with the continued or remittent forms, or with the quotidian type of intermittent; while those who had been stationed for a long time in the city or its vicinity, suffered from the tertian or quartan types of intermittent fever. Gastric and bilious complications are exceedingly prevalent in all forms and types of the disease, but more particularly so in the continued and remittent forms.

In the Roman Campagna fever exists independently of any visible marsh. A striking proof of the extreme insalubrity of this plain is the danger which attends even a short sojourn within its inhospitable confines. In this plain, says Colin, "we see only a few cultivated spots. The danger of encountering the exhalations is such, that the harvesting has to be done rapidly, stealthily, and with precipitation, in order that the sojourn in the plain may be as brief as possible. It seems as if each harvest were a sort of larceny committed upon this murderous soil."

But if the superficially dry plain is unhealthy, still more so are the marshy districts, such as Ostia and Porto Macarèse. Ostia is now comparatively deserted on account of its unhealthiness. Nor is it doubtful that the vicinity of the Pontine Marshes is more malarious than the Campagna generally. At Terracina the inhabitants suffer greatly from malarial fever and its results. Strangers contract the remittent, which may also affect the acclimatised in summer; but the tertian and quartan forms are the most prevalent among the natives in this and other towns and villages situated near the marshes. The

malarial cachexia is also prevalent amongst those who have been long subjected to the endemic influence.

Few parts of Italy appear to suffer more from malaria than Calabria. The country is mountainous. Although destitute of large rivers, it is watered by numerous mountain streams, which often overflow the low plains, leaving black and stinking swamps, which poison the surrounding districts. How far these conditions are to be accepted as explaining the feverishness of this province, I cannot say. I have not met with any precise information respecting the conditions under which malaria is generally met with in this part of Italy. Cozenza, one of the most important towns in this department, is situated in a narrow valley at the confluence of the Crati and Busento, which pass through the town. This part of the town is marshy and malarious; but the upper part is drier and healthier, showing the influence of stagnant moisture in determining the prevalence of malaria. It is probably to the existence of similar conditions in other parts of this department that Calabria owes its notorious liability to malarious diseases.

The towns along the southern shores of this department are notably malarious. In 1886, Catanzaro had a death-rate from malaria of 30·6, Cotrone of 30·4, and Gerace of 30·0 per 10,000 inhabitants, as against a mean of 5 per 10,000 for the 284 "Comuni" in the official returns.

The plains of Basilicata are very severely affected. Taken as a province, without reference to special districts, Basilicata is the most malarious region of Italy. The average death-rate from malarious diseases in this department for the six years ending 1886 was no less than 27·5 per 10,000 of the inhabitants, and these fevers gave rise to 822·2 per 10,000 of the deaths from all causes. In other words, about one in twelve of the deaths are due to malaria. Matera, in the province of Potenza, had a death-rate of 55·8 in 1885, and in 1886 of 85·0 per 10,000 from malarious diseases. This enormous malarial mortality is no doubt owing in part to the humidity of the soil; but much of it, we may suppose, is to be ascribed to the social habits of the natives, who dwell for the most part in caverns excavated in the side of the deep valley surrounding the town.

Apulia suffers in a less degree; but the shores of the Gulf of Taranto, and of the Gulf of Manfredonia, with its numerous brackish marshes, are far from salubrious. The average death-rate from malarial diseases is 14·6 per 10,000, which is a slightly higher rate than that of the Roman territory. Taranto, Brindisi,[1] and

[1] Dr. Patterson, of the British Seaman's Hospital at Constantinople, remarks on the specially malignant character of the malarial fevers contracted at Brindisi.

Foggia record death-rates from malaria in 1886 of 34·6, 45·9, and 25·1 per 10,000 respectively.

The plains of Abruzzo are subject to inundations. Large tracts of land lie waste and uncultivated, which amply accounts for the rather high incidence of fever in a province which is in many parts salubrious. The proportion of deaths per 10,000 inhabitants from malarious disease averages 8·4. The commune of Vasto, in this department, had a rate of 35·9 in 1886.

In Sicily the swamps are most numerous along the southern shores of the island, and it is here also that malaria is most intense. At Sciacca the deaths from this cause vary from 30·0 to 40·0 per 10,000. Terranova, the country around Syracuse, especially the district of Noto, the borders of the Lentini Lake, and the commune of Catania, are all more or less severely affected. Catania, next to Rome and Ferrara, is the most malarious town of Italy. In the neighbourhood of the town there are marshy tracts of considerable extent, which are productive of fever. In 1881 three officers belonging to the British navy went on a shooting expedition to these marshes. One of the three escaped the fever altogether, and this was ascribed to his having taken quinine as a prophylactic; the two others, who took no quinine, were attacked with fever, and one of them died.[1]

Palermo, situated on a fertile and well-cultivated plain, is fairly healthy. Trapani, in the north-west, appears to be much less favourably situated.

Sardinia must be regarded as decidedly malarious. Next to Basilicata and Calabria, it is indeed the most malarious department of Italy, and, judged by the military returns, it takes the first rank among the malarious regions of Italy—the deaths among the troops stationed in the island reaching 1·45 per 1000. Malaria has established itself in the Campagna since the decay of Rome, but it has made no new conquest in Sardinia, the insalubrity of which was well known from the earliest times.[2] Iglesias and Oristano on the west coast, both swampy districts, return year after year an enormous malarial death-rate. Oristano, for example, had a malarial fever death-rate of 76·5 in 1885, and of 63·8 in 1886, per 10,000. Iglesias is little better in this respect. Lanusei, on the east coast, is another focus of malaria. Although the marshy localities in Sardinia are

[1] *Navy Report*, 1881.

[2] "Actum et de sacris Ægyptiis Judaicisque pellendis factumque patrum consultum, ut quattuor milia libertini generis ea superstitione infecta, quis idonea ætas, in insulam Sardiniam veherentur cœrcendis illic latrociniis et, si ob gravitatem cœli interissent, vile damnum."—*Tact. Annal.* lib. 2, cap. 85.

the most deadly, the plains, apart from visible marsh, are, like the Roman Campagna, decidedly unhealthy.

The plains of Corsica, especially along the east coast, are highly malarious. Carlotti [1] considers the Makis, that is, the tracts covered with bushes and undergrowth, as productive of malaria. Other causes of the disease, according to this author, are the overflow of torrents and rivers, leaving behind deposits of mud; fish ponds, where fresh and salt water mix, and the rotting of seaweed along the shore. He states that fever sometimes reigns epidemically in localities placed in the best possible conditions as regards salubrity. In these instances he believes that the miasm is carried from a distant malarious *focus* by the agency of the winds; and he affirms that when such epidemies do occur in healthy localities, it is always observed that the winds at the time have been blowing from some centre of miasmatic infection. In another work, the same author says that 90 per cent. of those who sojourn on the plains are affected with malarious diseases. Scipion Gras, quoted by Colin, gives an equally unfavourable account of the climate of the Corsican plains. He remarks that, when the wheat is ripe, the farmer hastens to reap it and get back to his mountain village. If the harvest is retarded, he is under the necessity of abandoning it, or of compromising his health. The fertile plain of Aleria is like a trap laid for the neighbouring population. The fruits which are gathered there are mixed with the seeds of disease and death.[2]

In Malta paroxysmal fevers are unknown. Dr. Mufsid, in a private letter, says that "no malarial fever at the present day is to be met with in Malta, except as occurring in old emigrants returned from Cyprus and Alexandria." This is, upon the whole, borne out by the health of the troops stationed there. Since the occupation of Cyprus, and the arrival in Malta of troops from that island, paroxysmal fevers are not unfrequent; but they are not contracted in the island. During the period 1859–66 the admissions per 1000 of strength were 4·6, and the deaths 0·2, and there is no reason for supposing that even this small proportion was contracted on the spot.

While paroxysmal fevers are unknown among the natives and among the troops who have not contracted the germs of the disease in other places, a species of ephemeral fever is very common. This is described by Boileau [3] "as a sudden accession

[1] *Assainissement des régions chaudes insalubres*, Ajaccio 1875.

[2] Hirsch mentions that in recruiting for the army in Corsica, no fewer than 774·73 out of 1000 were found unfit for service, and these had been rendered unfit mostly by severe malarial illness.

[3] "Remarks on Fever in Malta," *Army Medical Report*, 1866.

of febrile phenomena of the continued type, gradually disappearing in about seven days by lysis, unaccompanied by any eruption, and characterised by debility, anorexia, thirst, white tongue, quick pulse, and frontal headache." There is often an aggravation of the symptoms about the third day; on the fourth day there is generally a decided amendment; exceptional cases may last for ten or eleven days. Jaundice, commencing about the fifth day, occurs occasionally. Severe muscular pains in the calves, insomnia, epistaxis, and vomiting are pretty common accompaniments; but bronchitis, diarrhœa, nocturnal sweating, and suppression of urine are seldom observed. The febris complicata, of long duration, to which we have alluded in speaking of Gibraltar, is also frequently met with; and there is good reason for believing that this fever is not uncommon in other Mediterranean countries.[1] Occasionally a remittent fever of a dangerous character prevails. In the year 1881 there were 69 admissions and 5 deaths among the troops from remittent fever. "Most of these cases had a yellow countenance, with heavy, dull expression; thickly-coated, yellow, waxen-like tongue; and a high temperature, almost resembling the bilious remittent of the West Indies."[2] It is not very clear what relation, if any, exists between this and the other forms of Maltese fever already mentioned.

The influence of *altitude* on the prevalence of malaria in Italy can best be illustrated by citing a few facts. The city of Sovana, in the Maremma, at an elevation of 325 feet, is notoriously unhealthy. In the Campagna, the town of Isola Farnèse, at an altitude of about 660 feet, is malarious. Albano, at 1250, and Frascati, at 1100 feet, are not entirely exempt; for Colin informs us that the lower streets of these towns, being enveloped in the fever-bearing fogs, suffer, while the higher placed streets of the same are healthy.

According to the same authority, the small villages of Rocco Priora and Rocco di Papa, at elevations of 2366 and 2663 feet respectively, are entirely free from malaria. In the more unhealthy parts of Italy, as we have already seen, the inhabitants take refuge in the mountains during the summer and autumn months, which is the testimony of experience to the comparative salubrity of the higher grounds. The limits of safety vary in different localities, and even in a particular locality it is difficult to fix the lowest point beyond which safety from malaria is attained.

The distribution of malaria according to season has now to be considered. We shall first give the average monthly per-

[1] Marston on "Mediterranean Remittent," *Army Medical Report*, 1861. Bruce, *Practitioner*, 1888.

[2] *Army Medical Report*, 1881.

centage of deaths from malarial fever for the kingdom of Italy, calculated upon the four years 1881, 1883, 1885, 1886:[1]—

January,	6·15	July,	9·24
February,	5·55	August,	14·50
March,	5·28	September,	14·03
April,	5·17	October,	12·48
May,	5·36	November,	9·46
June,	5·35	December,	7·37

It will be seen that the deaths from malarial fever begin to rise in July, and attain their maximum in August or September,—sometimes in the one month and sometimes in the other.

For Turin the monthly repartition of 201 deaths from intermittent fever occurring during the ten years 1828–37, as quoted by Lombard from an official work,[2] is given here, as we have no later statistics respecting the seasonal distribution of malaria in the north of Italy. We shall repeat the figures of the average mean temperature and rainfall, so that their relation to the evolution of fever may be the more readily understood:—

	Percentage of Deaths from Malarial Fever.	Average Mean Temperature.	Average Rainfall.
January,	2·5	−0·6	36·7
February,	2·5	2·4	29·6
March,	4·0	7·0	63·5
April,	6·4	11·5	103·2
May,	6·4	16·8	106·5
June,	2·5	20·3	92·8
July,	4·0	22·7	56·5
August,	12·9	22·9	82·5
September,	22·8	18·0	64·5
October,	16·9	12·5	73·4
November,	9·5	5·9	67·9
December,	9·5	0·7	49·8
		Total,	826·9

Here, as elsewhere throughout Italy, the death-rate from malarial fever attains its maximum in August, September, and October, the rise manifesting itself in July.

The highest mean temperature occurs in August, coincidently with a very decided increase in the fever mortality.

The distribution of the rainfall in Turin differs very considerably from that of many other parts of Italy—April, May, and June being here the wettest months, and not August, September, and

[1] *Statistica delle Cause di Morte*, Roma 1881, etc.

[2] *Informazioni Statistiche raccolte dalla Reale Commissione per gli Stati di Terra ferma*, t. iii., Torino 1840.

October, as in Rome, Naples, and elsewhere. Yet the monthly distribution of malaria, so far as this is indicated by the number of deaths, is much the same in Turin as in Rome,—a proof that the season of malaria is not determined solely by the periods of rain and drought.

For Rome our statistics deal with admissions, not with deaths; and, as in the case of Turin, we shall place in juxtaposition the average mean temperature and rainfall:—

TABLE OF ADMISSIONS INTO THE FRENCH ARMY AND HOSPITALS AT ROME FOR MALARIAL FEVER. MONTHLY ADMISSIONS PER CENT.

	Fever Admissions, French Army (Armand).[1]	Admissions into St. Esprit Hospital.[2]	Malignant Fevers (Baccelli).[3]	Average Mean Temperature.	Average Rainfall.[4]
January, . .	3·1	8·5	3·34	6·79	83·4
February, . .	3·7	7·5	0·67	8·89	63·8
March, . .	4·7	7·2	0·93	10·51	69·7
April, . . .	5·3	5·9	1·07	14·49	60·7
May, . . .	5·2	5·1	1·70	17·72	53·5
June, . . .	5·4	3·9	2·67	22·49	36·3
July, . . .	10·1	6·9	14·30	24·84	16·8
August, . .	24·7	12·9	30·62	25·27	26·3
September, .	17·6	11·6	20·59	21·82	63·1
October, . .	9·4	10·4	14·45	16·80	121·4
November, .	6·6	10·6	5·61	11·80	109·2
December, .	3·9	9·0	3·74	8·49	98·8

All these figures point to August as the month when malaria in Rome is at its height.[5] This is the month also of maximum temperature. But the fact that in June, with the high temperature of 22·49, and in May when the mean is 17·72, malarial fever is at its minimum, must also be borne in mind in estimating the influence of temperature upon the evolution of malaria. In September and October, with a temperature less than that of May and June, fever is also very prevalent. Of course it may be urged that the period of maximum prevalence of fever occurs after the high temperature has been persistent for some time.

[1] Armand's Observations for 1851–52 (Lombard).

[2] Admissions into St. Esprit Hospital, 1850–60 (Lombard).

[3] Two Years' Observations (Hirsch).

[4] Average from 1782 to 1885.

[5] Hirsch gives the monthly fever admissions from Balley into the Military Hospital of St. André at Rome for 1858–60. Balley's figures represent the maximum of admissions as occurring in October; but a reference to the numbers admitted for all diseases into the military hospitals for these years, as given by Colin, makes it clear that the strength of the troops was subject during this period to fluctuations which seem to deprive the results of any real value.

A sudden rise in the number of fever admissions takes place in July, when the rainfall is at its minimum ; and the greatest number of admissions is reached in August, when the rainfall is still very scanty. In October, when the heavy rains fall, the fever prevalence begins to diminish.

Colin informs us that cases of remittent fever were observed to begin amongst the French troops, with great regularity, about the 5th or 6th of July ; and he states, as a matter of observation, "that each of the first rains at the end of summer is followed by a recrudescence of fever." The number of admissions from intermittent fever attains its maximum, he says, about the 20th of July, and maintains this level until about the 20th of August, when their frequency declines very rapidly ; so that by the end of that month remittent fevers have become relatively rare, and by the month of September only a few isolated cases, lost, as it were, in the general mass of intermittents, are met with.

Thus, on the 21st of July 1864, there were fifteen cases of remittent under treatment to one case of intermittent ; on the 5th of August there were eighteen of remittent and four of intermittent ; while on the 5th of September the proportions were completely reversed, there being then only one case of remittent, and fifteen of intermittent fever in hospital.

The only other place in Italy for which I have obtained the monthly fever admissions for malarial fever is Terracina, near the Pontine Marshes. The following table, founded on the figures given by Colin, gives the monthly percentage of 6972 patients received into the Central Hospital during eleven years. As the patients are mostly furnished by the population in the neighbourhood of the marshes, there can be little doubt that the greater part of them suffered from fever or its consequences. The table may therefore be taken to indicate the monthly prevalence of fever in this region :—

Percentage of Patients admitted Monthly into the Central Hospital, Terracina.

January,	7·21	July,	11·90
February,	5·85	August,	13·16
March,	5·98	September,	10·71
April,	7·21	October,	8·99
May,	5·39	November,	8·76
June,	5·65	December,	9·16

The monthly distribution of fever is here the same as in Rome.

The autumn months are also the most unhealthly in Sardinia—the first notable increase in deaths from malaria occurring in July The month of maximum prevalence varies somewhat in different

years. In the deltas and near the mouths of rivers, the country is uninhabitable from July to October. Malaria is said to disappear with the first autumnal rains; but this is not uniformly the case.

The seasons are practically the same in Corsica as in Sardinia.

Years of heavy rainfall, especially if heavy rains precede the fever season, are at Rome years of the highest fever prevalence and mortality. The reverse is the case at Terracina, where dry years are the most unhealthy. Years of high temperature, such as 1865, at Rome are healthy, provided they are dry. Years in which the mean annual temperature is below the mean may be highly feverish, if the rains are even moderately abundant.

In Turin, as we have seen, 59 per cent. of the intermittent fevers are of the tertian type; 28 quotidian; 11 quartan; and 2 per cent. abnormal. The natives of Rome also suffer chiefly from the tertian type—the quotidian variety forming only about 10 per cent. of the admissions into St. Esprit Hospital in July and August. Quartans are by no means rare. The French troops in Rome appear to have suffered from a continued form of malarial fever, and such forms are also met with among the civil population; but the malarial nature of the continued fevers is in many cases open to doubt. The remittent type of fever is by no means rare, and, as we have seen, it is most common in the earlier part of the fever season.

At Terracina, near the Pontine Marshes, strangers suffer most from the continued and remittent forms, while the intermittent—especially the tertian and quartan—affect those who have been long subjected to the miasmatic influence.

Pernicious forms are frequent in Rome as well as in all the worst *foci* of malaria. The comatose is the form most frequently seen. The apoplectic (often without much, sometimes without any fever) is also met with. The delirious, the convulsive, the algid, and the choleraic are all far from rare. August is *par excellence* the month when the pernicious fevers abound; in September they are much less common, and become more and more rare until the succeeding June, when they begin to increase again in frequency.

Enteric Fever causes an average death-rate of 9·63 per 10,000 inhabitants, or 963 per million in the towns,—a proportion about four times that of England. In the Netherlands, a country which is to some considerable extent under the malarious influence, we observed that typhoid fever is rarer than in England; but that this demands some other explanation than the assumed antagonism between malaria and typhoid, is evident from the extreme prevalence of the disease in Italy; and the same thing will be further shown by comparing the distribution of the two diseases in Italy.

TABLE I.

AVERAGE DEATH-RATE FROM TYPHOID FEVER PER 10,000 LIVING.

1881–1886.			
Piedmont,	8·6	Latium,	5·2
Liguria,	5·8	Abruzzo,	9·6
Lombardy,	9·4	Campania,	7·2
Venice,	8·5	Apulia,	18·7
Emilia,	8·1	Basilicata,	9·4
Tuscany,	11·2	Calabria,	10·7
Marches,	6·2	Sicily,	14·3
Umbria,	6·6	Sardinia,	12·6

TABLE II.

ANNUAL PREVALENCE OF TYPHOID 1883–86 IN NINETEEN OF THE COMMUNES HAVING A POPULATION OVER 60,000.

	1883.	1884.	1885.	1886.	Average.
Naples,	6·4	6·4	6·5	4·9	6·05
Milan,	9·3	7·3	8·3	8·4	8·32
Rome,	4·6	4·6	5·0	4·9	4·78
Turin,	6·5	9·3	7·4	5·7	7·22
Palermo,	13·4	11·2	19·2	14·9	14·67
Genoa,	5·8	4·5	6·2	5·1	5·40
Florence,	8·5	6·9	10·5	11·1	9·25
Venice,	5·6	4·2	8·1	4·5	5·60
Messina,	7·9	10·1	12·3	8·6	9·72
Bologna,	7·2	4·5	5·4	6·6	5·09
Catania,	18·2	17·4	17·8	11·0	16·10
Leghorn,	12·7	12·1	6·1	8·6	9·87
Ferrara,	14·9	7·8	12·3	9·8	11·20
Padua,	6·9	7·0	11·2	10·6	8·92
Verona,	12·5	9·3	11·9	12·3	11·50
Lucca,	12·2	8·7	17·7	23·3	15·50
Alessandria,	3·2	3·7	4·3	4·9	4·02
Brescia,	26·1	17·3	9·8	6·0	14·80
Bari delle Puglie,	24·4	22·2	32·1	33·9	28·15

It will be seen, from the first of these tables, that typhoid fever bears with special severity on the southern departments. Apulia, Sicily, Sardinia, Calabria, are those most affected; but Tuscany in the north also stands out very prominently in the list of typhoid-stricken localities. If we compare these two tables with the corresponding ones showing the distribution of malaria, and with that giving the prevalence of the two diseases in the various districts of Tuscany, it will be seen that there is no law of mutual exclusion or antagonism between malarial and typhoid fevers, so far

as Italy is concerned. The department of Apulia, where typhoid fever is most prevalent, is one where malaria abounds.

Basilicata, Calabria, Sicily, and Sardinia are all highly malarious, and they all suffer severely from typhoid. Of the several districts of Tuscany, Grosseto is at once the most malarious and the one which is most devastated by typhoid fever. When we come to the communes, it will be seen that, as respects the relation between the frequency of these two diseases, the greatest diversity is manifest.

Some communes, where the deaths from malarial fever are comparatively few, such as Palermo and Lucca, are haunts of typhoid. Others, such as Catania, suffer severely from both diseases; while Rome, which of the larger towns of Italy has the heaviest death-rate from malaria, has the lowest death-rate from typhoid. In regard to towns, the extent to which typhoid prevails depends, no doubt, to a large extent upon the local sanitary conditions and on the water supply. In Rome the water supply is remarkably pure. At Bari delle Puglie, typhoid reaches the extraordinary proportion of 28·15 per 10,000 of the inhabitants, but we have no explanation of this excessive typhoid mortality. The geographical distribution of typhoid fever in relation to soil and climate is better shown by its prevalence in the departments as given in the first table; and it would seem, upon the whole, that the malarious districts in which the population is not massed in large cities have the highest typhoid death-rates.

We have already noticed that a considerable decrease in typhoid mortality was observed both in England and the Netherlands in 1885. This decrease did not extend to Italy. In England, as in Italy, typhoid was moderately prevalent in 1884; but a correspondence between the typhoid death-rate of the two countries is far from a constant one; in the year 1881, for example, the deaths from typhoid fever in England were comparatively few, but in Italy they were unusually numerous.

The average monthly percentage for three years of deaths from typhoid fever in Italy is as follows:—

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
6·69	6·48	6·82	7·24	7·26	7·22	9·36	11·25	11·08	10·61	8·58	7·37

The months in which typhoid fever is most fatal in Italy are August, September, and October, and these are precisely the months when it is most prevalent in England; they are also the months when malarial fever is at its height. This surely points to its miasmatic (we do not say malarious) origin.

The following are the annual death-rates per 10,000 for typhoid and malarial fevers from 1881 to 1886 for Italy:—

	1881.	1882.	1883.	1884.	1885.	1886.
Typhoid Fever, . .	9·6	9·4	9·3	8·8	10·3	9·4
Malarial Fever, . .	6·2	4·9	4·6	4·2	4·5	5·0

It will be seen that, as a rule, a rise or fall in the death-rate of one of these fevers is followed by a rise or fall in that of the other. The only exception to this was observed in 1886, when there was a decrease of typhoid and an increase of malarial fever. In Malta (1871–76) the admission-rate from enteric fever amongst the troops was 4·72, and the death-rate 1·57, per 1000, against the English ratios of 0·99 and 0·24. (*Army Medical Report*, 1878.)

Relapsing Fever is not mentioned in the death returns of Italy, and I do not find any notice of its epidemic occurrence in Italy in Hirsch's work. This is all the more remarkable, that relapsing fever is often associated with typhus, which is by no means rare in Italy.

Miliary Fever, or sweating sickness, has been repeatedly epidemic in Italy during the past and present centuries. In 1885 and 1886, *Febbre Migliare* is returned as the cause of 142 and 175 deaths respectively.

Diphtheria and *Diphtheritic Croup* give rise to an average death-rate of 7·73 per 10,000, or 773 per million. As the average death-rate in England from croup and diphtheria is 318 per million, these diseases are more than twice as prevalent in Italy.

In the Roman territory (Latium) its prevalence is about the average of the whole country. In Sardinia, a decidedly malarious region, it is below the average. Apulia and Basilicata are affected in a high degree, the mean death-rate in the latter for 1881–86 being 28·0 per 10,000. The months in which diphtheria is most prevalent are November, December, January, and February, its maximum being attained in December. The first and fourth quarters are about equally charged with diphtheric deaths.

Enteritis and *Diarrhœa* together give rise, on an average of six years, to 29·4 deaths per 10,000, or 2940 per million. In England we found that diarrhœa and enteritis occasioned, in 1884, 1094 deaths per million. We judge, then, that the death-rate of diarrhœal diseases in Italy is nearly thrice that of England. The high temperature of Italy is doubtless one of the causes of this excess, for few diseases are more influenced by temperature than diarrhœa.

The death-rate from *Dysentery* for the whole kingdom averages (1881–86) 2·2 per 10,000, or 220 per million, against an average of 28 per million in England.

The several departments give the following ratios of deaths from diarrhœa and enteritis, and from dysentery:—

	Diarrhœa and Enteritis.	Dysentery.		Diarrhœa and Enteritis.	Dysentery.
Piedmont, . .	31·3	0·87	Latium, . .	22·5	0·60
Liguria, . .	31·5	0·50	Abruzzo, . .	38·5	4·13
Lombardy, .	27·0	0·57	Campania, .	28·6	2·63
Venice, . .	23·0	0·97	Apulia, . .	44·6	2·40
Emilia, . .	23·2	1·23	Basilicata, .	56·3	8·03
Tuscany, . .	19·2	1·93	Calabria, . .	35·9	5·03
Marches, . .	28·9	0·96	Sicily, . .	40·5	6·03
Umbria, . .	22·0	4·00	Sardinia, . .	31·4	1·23

Both diarrhœa and dysentery are more common in the southern than in the northern departments of Italy. It will be noticed that Umbria, which is only slightly malarious, has a higher dysenteric death-rate than Rome, Sardinia, or Apulia, all of which suffer severely from malaria. Both diseases attain their maximum in the summer season.

Asiatic Cholera was epidemic in Italy in 1835–37, in 1854–55, and again in 1884–85. It has been less fatal in Italy than in most European countries. In 1884 the record of deaths from cholera was 10,940. Asiatic cholera has on five occasions prevailed in an epidemic form in Malta. 1. In 1837, when the outbreak lasted for 117 days, from June to October, causing 3792 deaths. 2. In 1850, when it was imported from Barbary. On this occasion the epidemy raged from 9th June to 13th October. The deaths in Malta and Gozo numbered 1736. 3. In 1865 the epidemy lasted for 155 days (9th June to 11th November). The deaths were 1479. 4. Cholera appeared for the fourth time on the 5th of July 1867, and lasted until 25th November, giving rise to 259 deaths. 5. In 1887 the disease broke out about the end of July, and lasted till 11th November, causing 462 death,—the villages suffering more than the towns. (*Pract.* vol. xlii.) We have already noticed the interesting fact that the commune of Grosseto has hitherto escaped cholera.

Typhus during recent years has occasioned a mortality of 0·27 per 10,000, or 27 per million, a ratio very similar to that observed in England. It is most frequent in Abruzzo, Campania, Calabria, and Sardinia, and attains its maximum from July to October. It has, however, been frequently epidemic in Italy during this century, no fewer than forty-five such outbreaks having been recorded by Corradi from 1816 to 1850, and Hirsch reckons six more between 1851 to 1873.

Scarlet Fever causes an average of 2·8 deaths per 10,000 (280

per million). It is thus only about half as common in Italy as in England. Apulia and Basilicata, where malaria, typhoid fever, and diphtheria reign, suffer most from scarlet fever. It is most fatal from August to December.

Measles account for a mortality of 5·7 per 10,000. This disease is least fatal in the malarious months July to November.

Smallpox caused an average mortality of 3·9 per 10,000 in the six years ending 1886. In England (1876–80) it was 0·78 per 10,000. It is most prevalent from October to January.

Erysipelas causes about 1·5 deaths per 10,000 living.

Whooping-Cough, which is most prevalent from March to July or August, gives rise to an average of 2·8 deaths per 10,000. It is thus comparatively rare in Italy.

Phthisis.—This disease is very fatal in Italy. The average deaths per 10,000, for the six years ending 1886, were 23·9 (2390 per million), as against an average in England (1881–85) of about 2080 per million.[1] We do not find in this any evidence of the alleged antagonism of malaria and phthisis. Let us see how the disease is distributed geographically in the several regions of Italy.

The specially malarious departments of Basilicata, Calabria, Sicily, Sardinia, and Apulia all show death-rates from phthisis considerably below the mean; while, on the other hand, the non-malarious departments of Lombardy, Liguria, and Piedmont exhibit high death-rates from phthisis. It is also to be noticed that the most malarious department of Italy (Basilicata) is that in which the death-rate from consumption is lowest. But two kinds of exceptions to the rule are to be noted. 1. In Rome we have an instance of a highly malarious region with a death-rate from phthisis very considerably over the mean. 2. In the Marches and Umbria we have two departments comparatively free from both diseases. There is clearly no dominating antagonism between consumption and malaria, otherwise Rome should be among the districts where phthisis is less frequent; nevertheless the excessively malarious regions in Italy, as a rule, suffer in a less degree from pulmonary phthisis. The minor degrees of malarial prevalence have certainly no tendency to reduce the fatality from phthisis.

Bronchitis and *Pneumonia*, which are classed together in the returns, cause in Italy an average death-rate of 46·1 per 10,000. Although pleurisy is not specially mentioned, it is doubtless included under the same heading. These three diseases gave rise, in 1884, to 29·9 deaths per 10,000 living in England; from which it appears

[1] This includes general tuberculosis, tubercular meningitis, and consumption. As regards England, we include tubercular meningitis.

that acute diseases of the respiratory organs are considerably more fatal in Italy than in England. They are most fatal in the departments of Campania, Calabria, and Piedmont, and least so in Sicily, Sardinia, Venetia, and Tuscany. Their prevalence is clearly not regulated by latitude.

Among the cities, Lucca, Palermo, and Bari delle Puglie are particularly favoured as respects exemption from this class of disease; while Naples and Turin show very high death-rates.

Bronchitis, pleurisy, and acute pneumonia are distinctly cold weather diseases in Italy; the death-rate from both affections show a decided rise in November, and a still more marked one in December. They are at their height in January, February, and March, and decline in frequency in April and May. Their minimum is attained in September.

Hepatitis causes an average death-rate of 2·53 per 10,000. It is remarkable that it is in the northern and least malarial departments—viz. Piedmont, Liguria, and Lombardy—that the deaths from inflammation of the liver are most frequent. It is rarely seen in the Maremma.

Cancer, including all malignant tumours, causes an average mortality of 647 per million, as against 544·6 in England. This disease is much more fatal in the north than in the south of Italy.

Pellagra is a disease which makes its appearance as an erythematous eruption on the back of the hands, face, or other parts of the body most exposed to the sun. The affected parts, or the extremities generally, are the seat of a burning or smarting sensation. The disease generally makes its first attack in spring. The eruption disappears or declines in the autumn and winter, leaving the skin dark, rough, and dry; the eruption returning in the following spring with greater intensity, implicating a larger surface, and accompanied by an aggravation of the constitutional symptoms. The affected skin becomes thickened, dry, fissured, and scaly. Gastro-intestinal symptoms, such as dyspepsia, diarrhœa, or constipation, supervene. Inflammation of the mouth and bleeding from the gums are also common. The nervous system is affected, as is evinced by giddiness, pains in the head, back, and extremities, and by tonic or clonic spasms, or paralysis, especially in the extensor muscles. The patients may have hallucinations or delirium; they often exhibit symptoms of melancholia, with a tendency to suicide. The disease runs a chronic course, lasting from three to nine or ten years. This disease was observed for the first time in Italy about the year 1730, which is the time when maize came into general use in Italy as an article of diet. Its area of prevalence coincides with that in which maize forms an important part of the food of the

people, and the disease principally attacks the agricultural labourers.

The most probable view of the etiology of pellagra is that which ascribes it to the use of damaged maize; but whether this disease is owing directly to a fungus, or to a chemical poison developed in the corn, is not quite clear. Perhaps the latter theory has most to be said in its favour, although it may well be that the chemical poison is itself the result of fungoid diseases.

The departments south of Rome did not return a single death from pellagra for the six years 1881–86. In the departments to the north of Rome it caused a death-rate in 1881–84 of 3·5; in 1885, of 2·4; and in 1886, of 2·3, per 10,000. The disease is thus decreasing very considerably at the present time.

Venetia is the department most affected, the deaths numbering on an average 10 per 10,000. Lombardy takes the second place, with a death-rate of 6·7. Emilia, the Marches, Tuscany, and Piedmont suffer in a much lesser degree. The greatest number of deaths from this disease occur from March to August. We have already noticed the spring and summer exacerbations of the symptoms of the disease, which so far explain the greater mortality of the spring and summer seasons; but I know of no explanation, upon the maize theory of the disease, why it should break out and become aggravated during these months.

Goitre and *Cretinism* are endemic "in the district of Aosta, at the foot of Mont Blanc, and in the valleys of the Alpine chain which traverses Piedmont and Lombardy. . . . And in Venetian territory, in the valleys of the provinces of Belluno and Udine. It is also met with on the northern slopes of the Apennine range, in Piedmont, Liguria, and Emilia, and in a few localities in Umbria, Abruzzo, and Terra di Lavorno." (Hirsch.)

Scrofula causes a mortality of 1·6 per 10,000, or 160 per million. It is most prevalent in Tuscany, Sardinia, and Venetia, and least so in Basilicata. *Tabes Mesenterica* is credited with a death-rate of 6·1 per 10,000, which shows that it is prevalent in Italy.

Acute Articular Rheumatism gives rise to a death-rate of 50 per million.

Leprosy is fast dying out on the Gulf of Genoa. In Comacchio, in Venetia, this disease is endemic, but not to any great extent, and it is met with at numerous points along the coast of Sicily.

Syphilis causes a death-rate of 1·4 per 10,000; the two departments that suffer most being Umbria and Latium. Of the large cities, Naples, Milan, Florence, Messina, and Ferrara are most affected. It is less fatal in Verona, Alexandria, Venice, and Leghorn.

CHAPTER XVIII.

MONTENEGRO AND ALBANIA.

MONTENEGRO lies to the south of Dalmatia, having Herzegovina on the north, Bosnia on the east, and the province of Skutari on the south.

In the low country or *zeta*, the winters are mild but the summers are very hot. In the high lands the winters are long, cold, and humid (Rey). Dr. Ferrière, who stayed for several weeks at Bjelopawlitsch, treated sixty cases of fever, all coming from Danilograd in the valley of the Jetla (Lombard).

In the low country malarious fevers are met with towards the end of summer and autumn, and result in great enlargement of the spleen and in cachexia.

Cattaro and its vicinity, and Budua on the coast, are specially mentioned as malarious. The mountainous region is free from malaria.

Dysentery is rarely seen in Montenegro.

ALBANIA, a province of European Turkey, stretches along the eastern shores of the Adriatic from Montenegro on the north to Greece on the south. The northern part corresponds to the Illyria of the ancients, and the southern part to Epirus. On the eastern boundary are the ranges of the Bora-Dagh and the Pindus; the coast line is low, and in many places covered with swamps and lagoons, especially about Valona and to the north of Samana Point, and along Saiada Bay.

Numerous rivers, but of no great magnitude, descend from the mountain range continuous with the Pindus chain, which forms the eastern boundary.

The largest lakes are the Skutari, the Ochrida, and the Janina.

The mean temperature of the year at Janina is 58° F. That of winter 40° F., and that of summer 73° F. The mean thermometric range is 40°·1 F., and the extreme range as high as 92° F.[1] The

[1] Stuart, *Journal R. Geo. Soc.*, 1869.

rainfall averages about 50 inches. From April to September the rains are scanty, but from October to March they are heavy.

Malaria.—The coasts and valleys of Albania are malarious. Stuart says of Butrinto (opposite Corfu), "that the pastures are almost deserted, and fever and ague await the sportsman who would visit the place."

Schlæfli received 1600 cases of malarial fever into the military hospital of Janina, on a mean effective of 19,000. Of 1591 cases of which the type is mentioned, 679 were tertian, 751 quotidian, 31 quartan, 127 remittent, 2 were masked ague, and 1 a pernicious attack.[1]

Typhoid Fever is not unknown in this province. Dr. Schlæfli having treated 114 cases in Janina.

Typhus does not appear to be endemic in the country.

Smallpox and *Measles* appear as epidemies from time to time, but *Scarlatina* is seldom seen.

Dysentery does not appear to be a common disease at the higher elevations, but it is doubtful if the coasts enjoy a similar immunity.

Pneumonia, Bronchitis, Pleurisy, and *Phthisis* are frequently met with, both on the coast and in the interior.

Rheumatism is common, but we have no means of comparing its relative frequency on the coasts and in the interior.

[1] *Versuch, einer Climatologie des Thales von Janina,* Zurich 1865.

CHAPTER XIX.

GREECE.

Geography.—Greece, bounded on the north by Turkey, occupies the southern part of the eastern peninsula of Europe. The outline of the country is very irregular, being in many places indented, and at one part almost intersected, by gulfs, and surrounded by clusters of islands.

Its area is 25,041 square miles, with a population, in 1889, of 2,187,208.

The Pindus range of mountains, which is the eastern boundary of Albania, forms the western limits of Thessaly (Trikale), which is separated from Macedonia by the Olympus range. This range, branching off from the Pindus chain, runs down towards the Gulf of Salonika. Another cross range from the same chain, running to the Gulf of Volo, forms the southern boundary of Thessaly. The Pindus range is then continued to the south-east, spurs being given off to the south-west towards the Gulf of Corinth. The Morea or Peloponnesus is traversed by a range running from east to west more or less parallel with the Gulf of Corinth. From this a range is given off which runs down the centre of the Morea, ending in Cape Matapan. The three great plains of Greece are those of Thessaly, Bœtia, and Messenia; but numerous smaller plains exist along the Gulf of Corinth, the Gulf of Arta, and elsewhere.

The rivers are numerous but small. The principal lakes are Lake Karla in Thessaly and Lake Topolias in Bœtia; but small lakes are numerous among the mountains, some of which dry up in summer, or become converted into swamps.

Of the Greek islands the largest is Negropont (Eubœa). The principal islands of the Cyclades Group are Andros, Naxos, Paros, Syra, Tinos, Santorin, Milo, and with these we may include Ægina. Crete, although under Turkish rule, is a Greek island, and shall be considered as such. The Ionian Islands skirt the western coast.

Climatology.—Greece has many varieties of climate, according

to altitude. The higher mountains are covered with snow during the winter months; the lower ranges enjoy a more temperate climate; while the plains and lower valleys are subjected during summer to extreme heat.

The mean annual temperature of Athens is 17°·6. In summer it is 27°·3; in winter, 7°·9. The rainfall only reaches 385 mm.

In the Ionian Islands the mean temperature of the year is somewhat higher than at Athens; the summer is cooler, but the winter temperature is nearly 7 degrees higher. The rainy seasons are summer and winter.

Pathology. — *Malaria.* — The elevated lands in continental Greece are generally healthy; the littoral, the plains, and lower lying valleys are in many places malarious. Malaria is endemic in the Thessalian plain, especially along the borders of lakes, the banks of rivers, and on the shores of the Gulf of Volo and of the Ægean Sea. The swampy shores of Lake Topolias and those of the smaller lakes of Bœtia are also notoriously unhealthy, as, in a lesser degree, is the Theban plain in general. The town of Athens and its neighbourhood is not free from the disease. Pernicious fevers and the malarial cachexia cause 14·2 per 1000 of the total deaths (Lombard). Foci of malaria exist on both shores of the Gulf of Corinth. The plains of the Morea are in many places rather severely affected. Boudin,[1] who accompanied the French expedition to the Morea in 1820, witnessed, as he states, the sad drama which was enacted among the marshes of Navarino, in which an army was cruelly decimated by malaria without having to fight a battle.

But other conditions of soil in Greece are almost equally favourable to the production of malaria. Thus at Modon, not far from Navarino, there are, according to Faure, no marshes; but, as he tells us, a part of the plain is covered with water during the rains, and this water does not run off, but evaporates with the first heats. He adds that it is not necessary to dig far to find water. Here also the French troops suffered greatly from fevers. At Patras, on the Gulf of Corinth, fever was very common among the French troops during that war, the greatest number of admissions taking place in October, November, and December. The two large islands, Negropont and Crete, differ, as regards the prevalence of malaria, in no respect from the mainland.

The island of Ægina is upon the whole healthy, although its eastern shores are said to be feverish. Syra, arid and rocky, is visited in summer by pernicious fevers. Tinos is also to some extent malarious during the hot season. Respecting the pathology

[1] *Traité de fièvres intermittentes,* Paris 1842.

of the other islands of the Cyclades Group, I have come across no trustworthy information.

The English found the Ionian Islands, although the soil is naked and dry, not to be entirely exempt from paroxysmal fevers. Continued fevers, however, of uncertain character were those that predominated and proved most fatal, as will be seen by the following figures :—

	1837–46. Per 1000 of Strength.		1859–61. Per 1000 of Strength.	
	Admitted.	Died.	Admitted.	Died.
Paroxysmal Fevers, . . .	79·6	2·33	32·0	0·42
Continued Fever, . . .	190·6	3·47	149·0	4·40
Dysentery, Diarrhœa, and Cholera,	114·7	1·03	...	...

This table shows that during the later years of the English occupation a considerable reduction in the number of paroxysmal fevers had taken place. It must further be remarked that the highest figures of the most unhealthy period do not indicate that these islands are subject, except in a moderate degree, to malarious influences. These fevers are most common from October to December.

Typhoid Fever was, no doubt, included in the English returns under the term "continued fever," which appears to have been so fatal to the troops stationed in the Ionian Islands. This disease occupies an important place among the causes of death at Athens, and is doubtless general throughout the country.

Typhus is not endemic in Greece.

Relapsing Fever and *Bilious Typhoid* are believed to be endemic in Greece, but I have not met with any exact accounts as to their occurrence either on the continent or the islands.

Diphtheria made its first appearance in Greece in 1865 at Phthiotis (Hellas), where it has continued to be endemic (Hirsch).

Croup appears to be seldom met with.

Cerebro-spinal Meningitis was epidemic at Phthiotis in 1863–64, and in 1868 it appeared in Nauplia and Milos, extending in the succeeding years to every province of the kingdom, with the exception of the Ionian Islands.

Smallpox and *Measles* do not appear to be more common in Greece than in the rest of Europe.

Scarlet Fever appears in an epidemic form, but it is perhaps less fatal than in Northern Europe.

Diarrhœa, Cholera Infantum, and *Enteritis* are common and fatal affections during summer and the early weeks of autumn.

Dysentery is endemic in many parts of Greece, continental and insular, especially in localities where paludal conditions prevail; but it is also met with in dry regions, such as the Ionian Islands, where no marshes exist.

Phthisis is frequent and fatal in Athens, where, in 1877, it caused 183·4 of the total deaths; and it is met with but to a very moderate extent throughout the country.

Pneumonia, *Bronchitis*, and *Pleurisy* are diseases of common occurrence in Greece, but they do not give rise to so great a mortality as in England. Bronchitis especially is of a milder type than in the north of Europe.

Hepatitis and *Abscess of the Liver* are of somewhat frequent occurrence in Greece, especially in malarious localities.

Rheumatism is somewhat prevalent, judging by the returns of the English troops stationed in the Ionian Islands. *Rheumatic Fever*, on the other hand, is seldom seen in Sparta, Nauplia, and Livadia.

Syphilis.—A form of syphilis known as *spirokolon* broke out during the war of 1820–25, and was supposed to have been introduced by Egyptian troops. It was characterised by mucous patches around the anus, followed by ulcerations, as in the case of radesyge. It was believed to be communicable by ordinary intercourse.

Leprosy still exists in Greece, but, excepting on the high lands in the interior of Crete, lepers are nowhere numerous. Here Hirsch, on the authority of Smart,[1] estimates them to form 3·6 per 1000 of the population.

Ponos is a peculiar disease of early childhood, characterised by wasting, enlargement of the spleen, hæmorrhage from the gums, and petechiæ or ecchymoses of the skin. Its cause and nature are unknown. It is only met with in the islands of Spezza and Hydra.

Aleppo Boil is endemic in Crete.

[1] *Med. Times and Gazette*, Oct. 1853.

CHAPTER XX.

ROUMANIA, SERVIA, BULGARIA, ROUMELIA.

GEOGRAPHY.—Servia, Bulgaria, and Roumelia occupy the eastern and larger part of the Balkan peninsula, having the Save and the Lower Danube on the north, the Ægean Sea and Greece on the south, the Black Sea and the Sea of Marmora on the east, and Bosnia and Albania on the west. Roumania is also partly a Balkan State, as the province of Wallachia, although situated beyond the Danube, belongs geographically to the peninsula, while Moldavia, stretching northwards between the Carpathians and the Pruth, is outside its limits.

The following table gives the area and population of the several States :—

State.	Area in Square Miles.	Population.
Roumania,	48,307	6,000,000
Servia,	18,757	2,013,691
Bulgaria and Eastern Roumelia,	38,560	2,984,000
Turkish Roumelia,	63,875	4,500,000

The capital of Roumania is *Bucharest,* population 221,805 ; that of Servia is *Belgrade,* population 38,313 ; of Bulgaria, *Sofia,* population 30,428 ; of Turkish Roumelia, *Constantinople,* population 875,000.

As our acquaintance with the pathology of these countries is so limited, it would serve no good purpose to enter into any minute geographical details. Suffice it to say that this region is hilly, being intersected by the Balkans, the Dinaric Alps, the Pindus Mountains, the Despoto Dagh range, and their numerous offshoots. On the north is the Wallachian plain, traversed by numerous tributaries of the Danube descending from the Carpathian Mountains. The country on the left bank of the Danube from Galatz downwards is excessively marshy, as is also the Dobrudja, which stretches between the shores of the Black Sea and the Danube in that part of its course, where, turning north, it runs parallel to the Black Sea. The valleys of the Drin and Morava, and the banks of the Save

in Servia; of the Maritza, the Kara-Su, the Struma, the Vardar, and other rivers in Roumelia, present many marshy localities.

CLIMATOLOGY.—The climate of the whole of this region is extreme. The winters are excessively cold, especially in the mountain regions, and the summer heat is very great. The mean temperature of the year at Constantinople is given by Hann as 16°·3; that of January as 5°·8, and of July as 23°·5. Bucharest has a mean annual temperature of 9°·3. In winter the thermometer falls to −20°, or even to −25°. The mean of summer is 19°·5.

The rainfall varies greatly in amount in different parts of this region. Autumn is the rainy season.

VITAL STATISTICS.—The marriage, birth, and death rates of Roumania in 1887 were 28·4, 38·1, and 27·86 respectively. Those for Servia in 1885 were stated to be 16·8, 45·0, and 25·9 per 1000. The marriages that year appear to have been fewer than in the preceding or following years. These figures, although official, must be received with reserve.

At Constantinople, winter is the most unhealthy season, then spring and summer, while autumn is the season when the mortality is at its minimum.

PATHOLOGY.—*Malaria* is intense throughout those districts in Roumania which stretch along the left bank of the Danube. At Galatz and its neighbourhood, malarious diseases prevail to a large extent, as is shown by the frequent occurrence of the disease among the men belonging to the British ships of war stationed at this place.[1] The banks of the Lower Danube are throughout very severely affected. Here fevers prevail in spring after the subsidence of the waters, and again in autumn after the first rains. In summer they assume a bilious remittent form. The inhabitants of the swampy districts suffer from malarial cachexia and enlarged spleen. That part of Roumania which is known as the Dobrudja, extending along the shores of the Black Sea, is intensely malarious. The fevers here commence in June, and last until the end of autumn. Remittent and quotidian forms are the earliest to show themselves, while tertians prevail in August and September, and quartans towards the end of autumn. Here also the malarial cachexia sets its mark on the inhabitants. The northern slopes of the Balkans are healthy.

The hilly districts of Servia are healthy, but malaria prevails along the banks of the Save and its tributaries.

In Roumelia, fever is most generally met with along the shores of the Ægean Sea, the Sea of Marmora, and the Black Sea. The

[1] *Navy Health Reports*, 1881, and others.

sailors visiting Gallipoli and its environs frequently suffer severely from fever, but I have no information respecting other parts of the coast between Gallipoli and Salonika. The southern slopes of the Balkans are free from fever.

Adrianople, built on the slope of a hill at the base of which flow the Toundja and Maritza, suffers from malaria. Half of the admissions among the French troops stationed here in 1854 were from malarial fevers. They were generally of the quotidian type (Rey). Malarial fever, frequently with great enlargement of the spleen, is also prevalent in those parts of Constantinople close to the shores of the Bosphorus.

Typhoid Fever is met with more or less throughout the whole of this region. Lecomte [1] bears witness to its frequency in the region of the Lower Danube. At Bucharest the deaths from typhoid fever were 0·53 per 1000 in 1885, and 0·57 in 1886. Its severity in Adrianople was experienced by the French army in 1854, while numerous authorities attest its prevalence in Constantinople. So far as we know, no part of Turkey in Europe is exempt from this disease.

Typhus has frequently been epidemic in Bulgaria, Servia, Roumania, and Roumelia, especially during and after wars, the disease being disseminated by the soldiers; but it is doubtful whether typhus is endemic at the present day in any of these countries.

Relapsing Fever and *Bilious Typhoid* will probably be found to be endemic in Turkey. Hirsch suggests that the "bilious typhoid" observed by Rigler at Constantinople in 1843 was of this nature. As yet, however, no positive evidence of its presence has been obtained. *Cerebo-spinal Fever* has not been observed in any of these countries, with the exception of a slight epidemy at Jassy in Moldavia in 1869. The *Eruptive Fevers* present nothing special, either as regards prevalence or type, requiring notice, except that smallpox is more prevalent than in Western Europe.

Asiatic Cholera has extended to every country between the Adriatic and the Black Sea, during one or other of its epidemic outbreaks in Europe; while Roumania, Bulgaria, and Roumelia have repeatedly suffered from destructive epidemies of this pestilence.

The Plague.—During the Middle Ages, when the plague was so frequently appearing in an epidemic form over a great part of Europe, Turkey and the adjoining countries were special endemic centres of the infection. After the disease had ceased its inroads into Western Europe, it maintained its footing in Turkey, from whence it extended, from time to time, to the south and east of Europe. During the present century, plague was epidemic in

[1] *Considérations sur la pathologie des provinces du Bas-Danube*, Montpell. 1867.

Turkey in 1811–13, in 1828–29, in 1834, in 1836–39, and finally, in Constantinople, in 1841, when its long centuries of prevalence in this country came to an end. Since that time down to the present day Turkey has been free from plague.

Diphtheria made its first appearance in Roumania in the year 1868, from whence it spread to Transylvania and Bessarabia and to many parts of Turkey. To what extent *Croup* prevails in these regions is somewhat uncertain. According to Lombard, it makes many victims at Constantinople, especially in the months of December, under the influence of the cold north-west winds; but Marroin's observations cast some doubt on the accuracy of this statement.[1]

Diarrhœa is excessively common throughout Turkey and the dependent kingdoms. In the large towns, diarrhœal complaints give rise to a great mortality among the young during the summer season, when the temperature is high.

Dysentery, comparatively rare in the hilly districts of Servia, Roumania, and Bulgaria, is one of the most fatal diseases of the low lands of Roumania and Bulgaria, and is also generally diffused throughout Eastern Roumelia and Macedonia. The French troops suffered severely from dysentery at Adrianople in 1854. It is also frequently met with at Constantinople.

Phthisis, according to Lecomte, is a common malady in Roumania and Bulgaria. All observers agree in regarding it as one of the most frequent and fatal diseases at Constantinople and the other large towns in Turkey.

Pneumonia, *Bronchitis*, and *Pleurisy*. — Although numerous accounts attest the greater or lesser frequency of these affections in Turkey and the adjoining countries, we have no means of estimating their comparative prevalence in different regions or localities. In Constantinople, chest affections are said to be quite as common as in the large towns of Western Europe.

Rheumatic Diseases.—Turkey enjoys no immunity from these ubiquitous affections. In Constantinople, rheumatic fever, with heart complications, is said by Rigler to be of frequent occurrence.

Hepatitis is far from rare in Turkey, and abscess of the liver is occasionally met with.

Scrofula is widely diffused throughout these countries.

Syphilis is believed to be more prevalent in these regions than in Europe generally, but in the absence of statistical evidence there can be no certainty upon the point. In Roumania, in particular, it is stated that almost all the inhabitants suffer from venereal diseases

[1] *Archiv. de méd. nav.*, December 1869.

—young and old, infants and adults, both in town and country (Lombard). Let us hope that there is some exaggeration in this statement.

Leprosy is unknown in Roumania, is rare in Macedonia, and is still more rare in Constantinople.

Pellagra is prevalent in Moldavia and Wallachia, especially in the former, where it is said to have been observed for the first time in 1846. It is ascribed to the use of a maize diet.

Goitre is endemic in a few mountain districts in Moldavia and Wallachia, where *Cretinism* is, however, for the most part, merely sporadic.

ASIA.

DIVISION I.

NORTHERN AND WESTERN ASIA.

CHAPTER I.

SIBERIA, KIRGHIZ-LAND.

Geography.—Siberia is bounded on the north by the Arctic Ocean, on the west by the Ural Mountains, on the east by the Kamchatka Sea, the Sea of Okhotsk, and the Sea of Japan. It is bounded on the south by the Kirghiz country, by Mongolia, and Manchooria. The area of Siberia is reckoned to be about 4,660,415 square miles. Its population is estimated at three and a half millions only.

Much of the country bordering upon the Arctic Sea is composed of swamp and moor, thawing for a few inches only during summer. To this succeeds a semi-barren zone, which again, as we proceed to the south, merges into forest, and in lat. 64° in the west and 61° in the east the cultivation of the hardy cereals can be carried on. Western Siberia is a great plain sloping northward to the Arctic Ocean.

Four-fifths of the country is drained by three great rivers—the Obi, the Yenisei, and the Lena, all of which fall into the Arctic Ocean. Numerous lakes, many of them brackish, are scattered over this immense country; of these, Lake Balkash and Lake Baikal are the largest. Kirghiz-land has the Ural River and the Caspian Sea on the west, Mongolia on the east, Turkestan on the south, and is continuous with Siberia in the north. It is a vast sterile steppe or plain, with few rivers,—those which do exist terminating in marshes or brackish lakes. It is covered in some parts with rank herbage, in others it is bare sand. The Aral Sea occupies the south of this region, into which flow the Syr Daria, the ancient Jaxartes, and the Amu Daria or Oxus, which is called the Jihûn by the Turks and Persians.

Climatology.—The climate of Northern Siberia is excessively rigorous. In winter, spring, and autumn, the thermometer is always considerably below the freezing point, while in summer the temperature, according to the latitude, varies between 7° C. and 10° C. At Tobolsk (lat. 58° 12′) the summer temperature reaches 17°·6 C.;

while in winter the thermometer falls to $-16^{\circ}\cdot 9$. Orenburg, in lat. 51° N., at the western border of the Kirghiz steppes, has a mean annual temperature of $3^{\circ}\cdot 2$, that of July is $26^{\circ}\cdot 6$, and that of January -15°. Nertchinsk, about the same latitude in the east, has a summer temperature of $16^{\circ}\cdot 2$, that of winter being $-26^{\circ}\cdot 5$ (Lombard). At Irkutsk, 1536 feet above sea-level, the mean temperature ranges from $18^{\circ}\cdot 8$ in July to $-20^{\circ}\cdot 5$ in January. At Petropavlovski the temperature of July is $14^{\circ}\cdot 8$, that of January $-10^{\circ}\cdot 0$.

PATHOLOGY.—*Malarial Fever* is scarcely known in the extreme north of Siberia, although isolated cases apparently do occur in the provinces of Yeniseisk and Yakutsk. Malaria is met with more frequently, but still in a mild form, in the government of Tobolsk, around Omsk, and in Irkutsk around the shores of Lake Baikal. Hirsch states that malarious diseases occur at the mines of Smeinogorsk ($51^{\circ}\cdot 9$ N.), at Barnaul, and in the Barabinsky steppe, which is a marshy country, traversed by the Irtish, the Om, and the head-waters of the Obi, and covered with numerous lakes, the largest being Lake Chuni. The Kirghiz steppes are upon the whole healthy. The eastern shores of Siberia are non-malarious.

Typhoid Fever is not unknown, but its distribution is uncertain.

Typhus also appears to be common in the prisons, as at Tobolsk, and among the civil population of Irkutsk.

Relapsing Fever was epidemic in some parts of Siberia in 1866, and accounts seem to point to its not unfrequent occurrence in this region; but the confusion between typhoid, typhus, and bilious typhoid is so great, that it is difficult to decide in many instances what disease is referred to.

Influenza has not spared these northern regions during its pandemic extensions. Apart from these general extensions, epidemic influenza, or catarrh, similar to that observed in Iceland and the Faröe Islands, is of frequent occurrence in the northern districts.

Cholera spread in 1828 from Khiva to the hordes of the Kirghiz steppes, by whom it was carried to Orenburg on the west frontier in the succeeding year. In 1847 the pestilence spread from Orenburg to Tobolsk, extending over a great part of Western Siberia. This region was again overrun with the disease in 1871, the governments of Tobolsk and Tomsk being those chiefly affected. Lombard says that, after having ravaged China and Mongolia, cholera penetrated into Eastern Siberia; but I have met with no particulars as to this eastern extension. Kamchatka and the northern regions of Siberia have hitherto been unvisited by this disease.

I am not aware whether *Diphtheria* has hitherto been observed in Siberia.

Croup is said by Lombard not to be of frequent occurrence.

Dysentery is not unknown in the southern districts of Siberia. At Vladivostock it is never seen; and the same is true of Northern Siberia generally, although epidemies of the disease at Tobolsk and other localities have been observed, for the most part, in connection with scarcity.

Smallpox is said by Hirsch to have reached Siberia by way of Russia for the first time in 1630, spreading over the whole country, and causing great havoc. Kamchatka was only infected as late as 1767. Since that period down to quite recent years, this disease has frequently spread in destructive epidemies all over the country.

Measles and *Scarlet Fever* break out from time to time in an epidemic form in certain localities, but neither disease seems to be unusually prevalent or severe.

Whooping-Cough occurs, but it is rare and benign.

Bronchial Affections and *Pneumonia* are prevalent throughout Siberia; but whether they are more prevalent in the regions bordering on the Arctic Ocean than in the southern governments, is doubtful.

Phthisis is said to be quite unknown on the Kirghiz steppe, which is a low tract in some parts below the sea-level; and the disease is known to be rare in Tobolsk. At Nijni Kolimsk, on the borders of the Arctic Ocean, phthisis was not observed by Admiral Wrangel during his visit in the early part of the century. In no district of the country has it hitherto been reported as common; so that we are entitled to conclude that phthisis is of comparatively rare occurrence in Siberia.

Scrofula, on the other hand, is a common disease in many parts of the country. Its prevalence has been remarked at Tomsk; the region near Lake Baikal, and at Vladivostock, in the extreme east. On the Kirghiz steppe it is rare.

Rheumatic Fever is stated to be of frequent occurrence in Kamchatka and at Tomsk. Respecting other parts of the country we have no accounts.

Syphilis is seldom seen among the Samojeds in the north-west, and the cases that do occur are mild; but in other parts of the country it is very prevalent. This is the case as regards the Kirghiz steppe, where the disease is widespread and severe, as well as in the southern and central parts of the country. In Kamchatka syphilis is very prevalent, especially in Petropavlovski, where

Maurin found thirty severe cases of the disease in a population of 300 persons.[1]

Goitre is endemic in the valleys of the Lena and its tributaries, in the government of Irkutsk, where the number of goitrous persons is given for 1870 as 34,000 in a population of 366,000. It is also met with on the slopes of the Altai range in Tomsk, and in the circle of Nertchinsk. (Hirsch.)

[1] *Archiv. de méd. nav.*, 1877.

CHAPTER II.

WESTERN AND EASTERN TURKESTAN, MONGOLIA, MANCHOORIA, AND COREA.

WESTERN Turkestan has the Kirghiz steppes on the north, Afghanistan and Persia on the south; on the east it is bounded by Eastern Turkestan, and on the west by the Caspian and the Aral Sea.

Eastern Turkestan is bounded on the north by the Thian Shan Mountains, on the west by Western Turkestan, on the east by Mongolia, and on the south by Thibet and the Karakoram range.

Mongolia, which occupies the centre of Asia, includes the greater part of the great desert of Gobi. It is bounded on the north by Siberia, on the south by China, and on the east by Manchooria, which latter extends to the River Usuri and Corea on the east. Corea extends from Manchooria to the Sea of Japan on the north-east, and the Yellow Sea in the south-west.

Respecting the climatology and pathology of this great region, which may be said to extend across Asia from the Caspian Sea to the Sea of Japan, comparatively little is known. We shall therefore content ourselves with a few notes concerning individual localities respecting which we have come across particulars.

KHIVA is in great part a desert; the only fertile parts are those that are irrigated. The town of Khiva itself is situated on an oasis stretching from the mouth of the Oxus for 200 miles along its banks, and is irrigated by canals from that river; the soil is very fertile. In this irrigated district intermittent fevers prevail. Next to *ague, smallpox* and *ophthalmia* are the most common diseases. *Phthisis* is rare in Khiva.

The Merve Oasis, supplied by the Murgab River and the canals leading off from it, is, to a certain extent, malarious; but the country through which the lower waters of the Tejend flow is much more so. Malaria is also prevalent among the Yamuds.[1]

BOKHARA.—The land can only be cultivated in the vicinity of

[1] O'Donovan, *The Merv Oasis*, vol. ii. p. 388. London 1882.

the rivers, where irrigation can be carried on; the rest of the soil is a stiff and arid clay. The rivers are,—the Amu Daria (Oxus), the Zer-Afshan, and the Kurshi or Shehri Sebz. The temperature at the capital is $-4^\circ{\cdot}25$ in January. In summer the heat is insupportable. The country is almost rainless. The town of Bokhara, according to Vambéry, is one of the dirtiest and unhealthiest places in all Asia. *Goitre* is here unknown. *Ophthalmia* is very general among the inhabitants.

SAMARCAND, in the Khanate of Bokhara, situated four miles to the south of the Zer-Afshan, in the very fertile plain of Sogd, is also visited by malaria, but *dysentery* is rare. *Goitre* is unknown. *Leprosy* is here endemic to some extent.

BALKH is a desert, except in those localities where it is irrigated. In the irrigated districts, and in those inundated by the Oxus, intermittent fevers are common. Balkh and Bokhara and Turkestan generally were visited by *cholera* in 1827, 1845–46, 1859–61, 1865, and 1872.

KHOKAN, or KOKAND, in the upper basin of the Jaxartes, or Syr Daria, is extremely fertile and well populated. The town of Kokand, at an altitude of 1400 feet, is situated on the banks of the river. The rains here are very scanty. As in the other districts of which we have been treating, the summers are excessively hot and the winters cold. The district is largely irrigated. Intermittent fevers are very common in many districts of the Khanate. In this, as in all the other regions of Western Turkestan, malaria is most prevalent in July, August, and September. *Goitre* is very common in the capital, and in the hilly parts of the country.

YARKAND, in Eastern Turkestan, at the height of 3958 feet above the sea-level, is situated on a marshy plain. The temperature here undergoes considerable fluctuations; this at least was the case in August and September while Dr. Henderson and his party were there.[1] Thus the thermometer stood at 92° F. at 3 p.m. on 29th August, in a lofty verandah with a northern exposure, and this was the highest temperature recorded; the lowest temperature reached during the night was 47° F. on the 3rd September. The whole country of Eastern Turkestan traversed by this traveller and his party was free from malaria. "I doubt," he says, "if intermittent fever exists here." *Goitre* is frequent at Yarkand.

MONGOLIA.—The climate of Mongolia is marked by great extremes. At Ourga, in 47° 55′ N. lat., at an altitude of 1150 mètres, the temperature C. is as follows:—January, $-26^\circ{\cdot}7$; April, $1^\circ{\cdot}0$; July, $17^\circ{\cdot}7$; October, $-1^\circ{\cdot}9$; and of the year, $-2{\cdot}5^\circ$.

[1] *Lahore to Yarkand.* By George Henderson, M.D. London 1873.

According to Gilmour,[1] *ague* is very rare, although it is not altogether unknown in Mongolia. Indeed, it apparently occurs here at times in an epidemic form. *Rheumatism*, for the cure of which the natives resort to kneading, is the most prevalent disease. *Ophthalmia*, *itch*, and other skin diseases are prevalent. *Syphilis* is said by Morache to be very prevalent among the nomads of Mongolia (*Annal. d'hyg.*, 1870). Epidemies of *influenza*, or what is looked upon by the natives as catching colds, are of frequent occurrence. Hirsch refers to the existence of *Goitre* in the Mongolian districts of Thian Shan, and it is probable that the disease has a much wider distribution in Mongolia than is at present known.

MANCHOORIA.—The southern part of Manchooria is comparatively well known. On the south-west the country is a vast fertile alluvial plain. "The soil generally tends to be swampy." Numerous lagoons, covered with reeds, and swarming with water-fowl of every description, render it somewhat interesting, even at the bleakest season of the year. On the north-east the country is mountainous. The climate experiences marked extremes of heat and cold. In summer the temperature varies from 70° to 90° F., and in winter from 45° to 10° F. below zero. The rivers are generally frozen over by about the 20th November, and are not navigable till the middle of March. In the hills the extremes are not so great.

I add the temperature of Niu-chwang for 1865, reproduced by Williamson from the Trade Reports of T. J. Meadows, Esq., H.M. Consul there for that year:—

TABLE OF TEMPERATURE.

Month.	Coldest.		Warmest.	
	Morning, at Daybreak.	Afternoon, from 2 to 4 o'clock.	Morning, at Daybreak.	Afternoon, from 2 to 4 o'clock.
January, . .	–10°	3°	39°	44°
February, .	–10	7	35	50
March, . .	0	14	43	60
April, . .	27	41	53	68
May, . . .	41	52	65	74
June, . . .	57	70	76	84
July, . . .	62	74	79	87
August, . .	63	73	77	85
September, .	41	52	73	80
October, . .	28	42	66	71
November, .	7	17	52	61
December, .	–6	2	37	44

[1] *Among the Mongols.* By the Rev. James Gilmour, M.A. London 1888.

Manchooria generally appears to be free, or nearly free, from malarious diseases, except in some localities in the south, such as Fungkiang. Williamson mentions that Dr. Watson assured him that serious sickness is very rare among the foreign residents.[1] *Smallpox* and *Syphilis* are, however, very prevalent among the natives.

COREA.—The peninsula of Corea, extending between 34° 40′ and 42° 30′ N., and longitude 125° and 129° E., is separated from Manchooria by the rivers Ya-lu and Tu-mên.

The northern provinces are believed to be generally healthy, but the interior of the country is not much known. In the south, intermittent fevers are endemic, and the remittent type also occurs. At Seoul, the capital, the quartan and tertian types occur with almost equal frequency; but in the southern province the quartan type predominates, and the double quartan and the bi-quotidian types are also met with.[2]

Typhoid Fever, notwithstanding the existence of all the conditions supposed to favour its prevalence, appears to be rare in the capital.

Cholera has extended into Corea from China when it has been epidemic in that empire. *Diarrhœa* is a common disease at Seoul. *Smallpox* is frequently epidemic in the country.

Bronchitis and *Asthma* are stated to be of frequent occurrence; but Allen met with no case of *Pneumonia* during the six months April to September 1885.

Phthisis appears to be of frequent occurrence amongst the natives.

Beriberi is well known, but most of the cases seen by Allen came from the province of Chula-do, situated to the south-east of Corea.

Abscess of the Liver is rare, but *Jaundice* is a common malady.

Gonorrhœa is said to be "as common as intermittent fever," but is looked upon as of no moment.

Syphilis, known as the *Chinese Disease*, is widespread, and often grave.

Leprosy is frequently seen in all its forms.

[1] Williamson's "Notes on Manchuria," *Royal Geographical Society's Report*, 1869.
[2] Allen, *Archiv. de méd. nav.*, 1886.

CHAPTER III.

CYPRUS AND THE ISLANDS OF THE LEVANT, ASIA MINOR, ARMENIA, SYRIA, AND MESOPOTAMIA.

Geography.—Cyprus, situated in the Mediterranean, in the angle formed between the south-eastern coast of Asia Minor and Syria, lies between 34° 30′ and 35° 41′ N. latitude, and between 32° 15′ and 34° 35′ E. longitude. Its greatest length is about 140 miles, and its greatest breadth about 60 miles. Its area is 3584 square miles, with a population (in 1881) of 186,173. A range of mountains skirts its northern shore, from Cape Kormakiti to Cape Andreas. Another lofty range runs across the island, to the south of its centre, from west to east, terminating in a peak called Saint Croce, 12 miles west of Larnaca. This range sends numerous spurs southwards, forming valleys, through which streams find their way to the coast. The highest summits of this range are Mount Troödas (Olympus), 6590 feet, which is occupied during the summer season by the British troops, their cantonment standing at the height of 5720 feet above the sea; Mount Paputsa (Adelphi), 5380 feet; and Mount Makhæres, 4730 feet. The great plain of Messaria extends across the island between these ranges, from the Bay of Morphou to that of Famagusta (Ammochustus).

The principal river of Cyprus is the Pedæus, which rises in the southern range, and runs through the central and eastern parts of the Messaria plain, to fall into the sea at the distance of about four miles north of Famagusta. It can scarcely be said, however, to fall into the sea, for it has no defined mouth, and forms extensive marshes at its termination. The Idalia is a tributary of the Pedæus, rising from the same range. The Morphou River, rising between Mounts Paputsa and Makhæres, traverses the western part of the Messaria plain, to fall into the Bay of Morphou. The Diorizos, the Kuris, the Garilis, and the Helenes are a few of the smaller streams or rivulets that flow through the parallel valleys formed by the spurs running south from the central range. These dry up entirely, or nearly so, in summer. We have already noticed the

marshes formed at the mouth of the Pedæus. Salt lakes stretch for some miles along the shore south of Larnaca, but the island generally is not marshy. It is well, however, to note that local conditions here and there exist of a paludal character. Thus Lang, in his work on Cyprus, states that the town of Famagusta is encumbered with *débris*, and the covered pits, from which the Turks assaulted the castle in the sixteenth century, are stagnant marshes to-day.

Heidenstam's remarks on this point deserve attention, as they are the result of long experience and personal observation. He says, "Cyprus, generally speaking, is not a marshy country, at least if we adopt the hygienic acceptation of the word marsh. There exist, however, low situated localities in the plains, which, during winters of heavy rain, are submerged with the water, which finds its way from the surrounding heights and becomes stagnant; or under other circumstances, where the soil is dry and porous, large accumulations of subsoil water are met with; and lastly, in many of the principal towns and villages, owing to the overflow of defective watercourses or to the want of proper drainage, water is allowed to locate in low sites and there forms stagnant ponds. The above-mentioned accumulations, on a soil rich with organic matter of vegetable origin, form the malarial foci to which the fevers of this island must be attributed, and which would account for the prevalence of fever in what could be termed an epidemic form only after very rainy winters."

The town of Lefkosia, or Nikosia, on the Messaria plain, about 35 miles inland from Famagusta Bay, is the capital. It has a population of about 16,000.

CLIMATOLOGY.—The rains, which average about 14 inches, begin in October and continue until February, and are more abundant on the south coast than in the central plain.

The following is the average monthly rainfall and mean temperature at Nikosia and Larnaca for the years 1887–88:—

NIKOSIA—35° 11′ 6″ N.; 33° 22′ 20″ E. ALT. 509 FEET.

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Temperature—mean, 1887–88,	47·9	50·8	55·9	62·7	72·0	79·7	85·9	83·1	78·1	74·9	60·2	52·8
Rainfall—average, 1887–88,	1·59	1·36	0·76	1·27	0·78	2·01	0·00	0·00	0·31	0·39	0·94	3·14

LARNACA—34° 54′ 30″ N.; 33° 37′ 0″ E. ALT. 35 FEET.

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Temperature—mean, 1887–88,	52·1	54·1	58·0	63·9	70·2	76·7	83·7	84·3	79·9	77·7	65·1	57·7
Rainfall—average, 1887–88,	0·73	1·12	0·22	1·24	0·14	0·68	0·00	0·00	0·18	0·00	1·48	3·48

PATHOLOGY.—*Malaria.*—The fact that malaria prevails in Cyprus has long been known. The troops of St. Ludovic, when

passing through the island in 1259, suffered severely from fever. Lusignan, in his *Geography and History of the Island of Cyprus,* written in 1572, remarks that, though the climate of Cyprus is very fine, fevers often occur on the low plains. Castiglione, in 1663, notices the pernicious atmosphere emanating from stagnant waters. P. N. Mariono Marone da Maleo, in his *Terra Santa* (1669), mentions that in the plains and near the sea much water accumulates during the winter months, forming marshes, which are most unhealthy during the summer. Finally, Giovanni Mariti, in his *Viaggi per l'isola di Cipro,* notices the prevalence of tertians and quartans, and mentions Famagusta as being worse than any other part of the island.[1]

Our knowledge of the pathology of Cyprus may, however, be said to date from the period of the British occupation in 1878. This year is stated to have been an unusually warm one, but I have not come across any record of the temperature. The British troops landed in the beginning of July, and an epidemic fever soon began to manifest itself amongst them. The first notice of the sickness I have met with occurs in the *Lancet* of the 20th of July 1878. The epidemy had then declared itself. On 24th August, Colonel Stanley stated in Parliament that the proportion of sick did not exceed 6 per cent. In the first week of September the number actually in hospital amounted to 11·5 per cent., but about 25 per cent. of the strength were then sick. By the 28th of September the reports were more satisfactory, and the improvement continued, and became more marked in October and November.

In July, August, and September the disease was of a remittent form, marked, in many instances, by relapses, and was comparatively fatal; but from the middle of September the fever assumed a distinctly intermittent type, and was less grave. Although it is stated that the year 1878 was an unhealthy one in the Levant, we have no proof that the same fever which was epidemic in Cyprus was observed elsewhere.

The troops at Larnaca, Nikosia, Limasol, and in every other locality occupied by them, were affected.

It is further certain that the natives all over the island suffered from this epidemy to a greater or lesser extent; and in this respect it differs from the Walcheren expedition, in which the natives escaped from the fever that was so fatal to the British army. The Syrians, Maltese, Italians, and Greeks who accompanied or followed the expedition suffered as much as the British troops, and it was as fatal among them. (*Lancet,* 7th December 1878.) The

[1] *Cyprus Fevers,* Heidenstam, Colonial Office, Lond. 1886.

42nd Regiment, which had been in the Ashantee war, and the 101st, which had been long in India, enjoyed no immunity on account of their previous residence in malarious countries. The Indian native troops appear to have suffered equally with the British soldiers. (*Medical Times and Gazette*, 1878.) The marines, employed on duty on the beach or inland, were visited with the same disease. Out of a party of seamen and marines that had been detached for duty at Nikosia, 73 per cent. were attacked with the fever before the end of August; while among the beach party up to the same date only a few cases had occurred, and those were of a mild type. Later on, however, among the latter the attacks became more numerous and severe, and some of them, like the Nikosia cases, were attended with relapses. About the 12th of August fever first appeared among those of the men who had never quitted the ship *Minotaur*. (*Navy Report*, 1878.)

If the epidemy attacked every class, it is no less certain that all did not suffer equally. It was observed that in September the Royal Engineers were attacked in great numbers, and the disease amongst them assumed the form of a bilious remittent of a severe type. It is deserving of remark, in passing, that in 1881, when there was no epidemy in question, the Royal Engineers suffered much more from paroxysmal fevers than the troops generally, the admissions among the latter being in that year 140 per 1000, while among the Engineers the admissions were 842·4 per 1000. Is this to be explained by the nature of their duties, involving, in their case, more exposure in the sun and to the exhalations from the soil upturned in connection with the constructing of barracks and other public works?

We thus see that an epidemy raged in the summer of 1878 all over the Island of Cyprus, attaining its acme in August and September; that it affected natives and strangers; that even the sailors in the ships anchored off the coast, who had never landed, were not spared; and that it was at first, and during its height, of a remittent type, which, as the colder weather set in and the epidemy became less severe, was replaced by the intermittent form.

The number of admissions into hospital in 1878 for all febrile diseases was 3713·6 per 1000, of which 24·61 per 1000 died, and 78·30 were invalided. The fevers returned as remittent numbered 2203, and those returned as ague 895. We thus see that the epidemy, whatever may have been its nature, gave rise to great sickness and to subsequent loss of health, as is proved by the numbers rendered unfit for service by it. The mortality it occasioned, too, was by no means inconsiderable.

Such are the general facts regarding the epidemy upon which all are agreed.

Let us try to see what were the forms of fever actually observed in Cyprus during this epidemic period; and for this purpose we shall reproduce the original descriptions of the disease by the medical men who saw and treated it. Having done this, we shall be in a better position to consider the character of the epidemy.

Home says that the fevers "were only certain of the phenomena in the course of a disease due to the infection of the marsh miasm, which attacked many organs of the body, and might be fatal in a short time, through the changes produced in them, or in a longer time by the slower effect of the dyscrasia, which was set up as a consequence of its long continuance. . . . The illness rarely ended after one attack of fever, in a way that, in a favourable case, illness ends in the recovery of the patient, after an attack of typhus or rheumatic fever. . . . The access of fever might be followed after a few hours by an interval of comparative health—an intermission; or there might be an abatement of the fever for a few hours—a remission—followed by another access, and perhaps another, before the interval of comparative health sets in, or the remission might be so short and indistinct as to be undistinguishable. But it was characteristic of the fever in this illness that the access very often returned after a period of seven days from the last fall in the temperature. As in marsh fever in other places, the fever access might return every day, or every second, or every third or other day. In this fever the type was that of a seven-day access; but it rarely remained so long, as the access became irregular, was advanced or retarded, and the severer forms of a fever with remission tended normally to end in one with intermissions. The continuity of the illness was not broken, however, nor in every instance was the change for the better. The coma which came on in the cold stage of the fever was very dangerous." He adds that dysentery occurring with the fever as a secondary affection was dangerous, that hæmorrhages from the bowels, lungs, and stomach often accompanied the severer forms of the disease, and that it was frequently followed by anæmia and cachexia. (*Army Medical Report*, 1878.)

The surgeon of the *Black Prince* says that this form of remittent, while resembling the common type of this disease usually met with in these regions, presented in many respects peculiarities, among which were the following:—

1. The greater mildness of the febrile symptoms.[1]

[1] This is the only writer who describes the fever as even comparatively mild; but in the *Black Prince* the mortality was only one out of 147 sick,—of these 21 were

2. The unaccountable tendency to syncope, and the great prostration with which the seizure usually commenced in men, however previously robust.

3. Its liability to relapse, especially during the height of the epidemy in Cyprus in July and August. These relapses were of two kinds: either a definite high temperature attended with malaise, slight headache, and other febrile symptoms occurring from the tenth to the fourteenth day; or more frequently a return of vertigo, headache, bilious vomiting, or diarrhœa, with a temperature a little or not at all above the normal.

4. Greeks, Turks, and Indian troops seemed as liable to contract this disease as Englishmen.

5. The usual sequelæ of Mediterranean fever were infrequent.

6. The prevalence and persistence of fever in the ship, and its probable short period of incubation. In half of the relapsing cases the fever lasted about five days; a complete intermission then occurred, followed by a marked return of the fever in ten to fourteen days from the original seizure. The others had irregular relapses, in which a marked return of high temperature either did not occur or escaped observation. In rare cases two or more relapses were noticed, and no man thus affected was fit for active service for many months subsequently. (*Navy Report*, 1878, p. 13.)

The following is an account of the disease as seen in hospital: "On September 3, three or four men were admitted with relapses of fever, which were severe. Temperature, 103° to 105°. They were in hospital the first time from five to eight days, and had been out of hospital about seven days when the relapse occurred. In the course of a few days I had the opportunity of seeing primary attacks with the following general symptoms: sudden invasion, no shivering, intense frontal headache, great heat of skin, thirst, bilious vomiting, bowels generally confined, tenderness of liver and sometimes of spleen, tongue yellow or white fur. Temperature about 104° to 106°, occasionally with profuse perspiration. This lasted without any distinct remission for periods varying from two to seven days. The high temperature and other symptoms usually disappeared suddenly during the night, often with perspiration, sometimes with diarrhœa. Sometimes the temperature lingered a degree or two higher than normal for a day or two. Spongy and ulcerated gums were common in and out of the hospital." This writer adds that quinine had no effect upon the disease. This is probably the description to which Hirsch refers in his "Handbook,"

invalided. In the remittents of the Mediterranean the fatality is often more considerable.

and which, he says, "leaves no doubt that we have to do here with a form of relapsing fever running its course with bilious symptoms." (Hirsch, *Op. cit.* vol. i. p. 600.)

A medical correspondent of the *Lancet,* writing from Larnaca, describes the fever in very much the same terms as the above, noticing epistaxis as a symptom, but saying nothing of relapses.

The surgeon of the *Raleigh* notices its sudden accession, generally with a rigor, rapid rise of temperature to 104° and 105°, intense headache, pains in back, nausea, and diarrhœa. He adds that "in some cases delirium occurred, and hæmorrhage took place from the mucous membrane. In favourable cases a crisis was developed in from twenty-four to forty-eight hours, characterised by copious perspiration and a subsidence, more or less complete, of the acute symptoms; then followed some days of languor and anorexia, with a regular exacerbation of the fever every evening, while in the morning the pulse and temperature might be about normal. This condition lasted between one and four weeks.

Here we find a fever with hæmorrhage from the mucous membrane beginning as in remittent, and ending as in distinct intermittent, apparently without any intervals and relapses. (*Navy Report,* 1878.)

Are we to look upon this as only a modification of the relapsing type described above, or as a separate disease?

One case is recorded in the *Lancet* of November 30, 1878, in which the fever began on September 12, and lasted till the 17th, then relapsed on October 1,—that is, fourteen days from the date of the termination of the first access. In another case, the first seizure, without rigors, lasted seven days, and the patient had a similar attack three weeks later, which lasted four days. At the beginning of October he had an attack of ague. In a third case the patient was attacked with the usual symptoms,—giddiness, vomiting, heat of skin, and pains. The fever in this instance lasted for eighteen days, and after being out of hospital for about a fortnight, the patient had another attack of fever, which differed from the first by beginning with shivering. In a fourth case the fever is said to have lasted about ten days, then after an interval of a week it was followed by a second seizure. Such are some of the recorded cases.

A writer in the *Lancet* (December 7, 1878) remarks that remittent fever in Cyprus "always recurs on the seventh, fourteenth, or twenty-first day, and so on, resembling in this respect relapsing fever; but the temperature charts usually show a remission in thirty hours of the access, then a second remission."

We shall now see in what condition the invalids were found when they reached Netley. This is what Dr. Veale says upon the point: "Nine-tenths of those who came direct from Cyprus were suffering from malarial fever or its effects, as was evidenced by their sallow, worn, and cachectic aspect, but still more certainly by the fact that many of them were actually in the cold stage when they arrived." Some suffered from intermittent fever, others had relapses of the remittent type of a very severe nature,—the fever sometimes even assuming a pernicious character. In most cases the liver was enlarged—the spleen was also often enlarged, sometimes tender or painful. Many suffered from bronchitis, but it must be noted that the season was then very inclement. He observed in several cases purpura—blotches on the lower extremities, epistaxis with a certain degree of sponginess of the gums—but without any ulceration, effusions, or dyspnœa. Dysentery, as a complication, was very rare, but extremely intractable.

Dr. Veale found the history of the disease given by the men to be tolerably uniform. "They said that shortly after their arrival in camp, they suffered from a fever of sudden access and without rigors, which was attended with pains in the back and limbs, vomiting, thirst, constipation, and great prostration. After a period varying from three or four days to as many weeks, they would return to duty, but were soon seized again with an attack of a similar kind, and after two or three such attacks they began to have fever and ague."

What then was the nature of this epidemy? If we are content to shut our eyes to one half of the evidence, there would be little difficulty in deciding either in favour of the view that Hirsch takes, namely, that we have to do with an epidemy of relapsing fever, or, on the other hand, to accept the opinion of Home, that the epidemy was simply one of malarial fever of a severe character. The opinion of most of those who saw and treated the disease was certainly in favour of its malarial nature. But here we have to examine and weigh facts rather than opinions. The more carefully and impartially we consider this epidemy, the more the difficulties in coming to a positive decision become apparent. As regards the existence of malarial fever as a factor and as an important factor in this epidemy, there can, I think, be no doubt. The condition of the invalids when they reached Netley is conclusive upon this point. The disease, as seen on the *Raleigh*, if it is correctly described, was certainly not ordinary relapsing fever.

It was marked by sudden access, high and apparently continuous fever lasting for one or two days, followed by copious perspiration;

all of which symptoms were such as might occur either in malarial or relapsing fever; but then the disease assumed an intermittent character lasting from one to four weeks. There is no mention of relapses. The histories of the individual cases quoted above show relapses, but can we be at all sure that a relapse occurring, certainly in the first and second of the cases, twenty-one days after the date of the original seizure, is that of relapsing fever? It is extremely rare that the relapses in this fever should be protracted till the twenty-first day. Griesinger and Begbie do not seem to have observed relapses at so late a period of the disease.

Lebert states that "the interval of freedom from fever lasts on an average for one week, sometimes only four or five days, rarely two weeks or so." In the third case quoted, the primary access appears to have presented the usual symptoms of the epidemy, but after the patient had been eighteen days in hospital the second attack began a fortnight after his discharge; this makes thirty-two days from the date of the first access. I conclude that these cases were in all probability malarial. Then again there can be no doubt of the existence during the epidemy of cases of remittent fever without relapses, such as the earlier cases that occurred in the beach party of the *Minotaur*. These were also in all probability malarious.

Another remarkable feature of the disease as seen in the *Black Prince* was, that only half of the patients had regular relapses of fever, the others had what are called irregular relapses, characterised by vertigo, headache, bilious vomiting, or diarrhœa. If we assume that those cases in which true febrile phenomena recurred in ten, twelve, or fourteen days were cases of true relapsing fever, what are we to say of the cases in which the relapse was non-febrile? I think I am right in saying that these *dumb* or non-febrile relapses have never before been described as occurring in relapsing fever. Home says that the initial fever might either be of a remittent or intermittent form. It is certainly rare for the initial fever of genuine relapsing fever to be intermittent. All these facts tend to show that numerous cases occurred which were malarious in their nature. But we have, on the other hand, the fact that large numbers suffered from a primary access without distinct remission, often accompanied by hæmorrhages and ending by perspiration; and relapsing from the twelfth to the fourteenth day. Nothing could be more characteristic of relapsing fever than these symptoms; and if they had occurred in a non-malarious country, and not as part of an epidemy in which malaria played at least an important *rôle*, they would be perfectly decisive as to the nature of the affection. I do not place great weight upon the statement, that it is

"common for remittent fever in Cyprus to recur on the seventh, fourteenth, and twenty-first day, and so on," because, for anything we know to the contrary, relapsing fever may be endemic in Cyprus, and may have been mistaken for remittent. In estimating the diagnostic value of relapses occurring about the fourteenth day, the fact must not be lost sight of that malarial fevers often recur on the fourteenth day from the date of the original seizure. Granting that malarial fever existed at that time in Cyprus, the fact of the relapse occurring frequently from the twelfth to the fourteenth day does not conclusively establish the non-malarious character of the affection in the relapsing cases. Griesinger points out that the "relapses of malarial fever develop in the greater number of persons with a great regularity after fourteen days or after three weeks." Out of 182 cases of intermittent fever observed by him, the relapses occurred in fifty-three instances between the eleventh and fourteenth day. In the case of remittent fever the same period of relapse has been observed in Tonkin[1] and elsewhere. No more does the occurrence of epistaxis and other hæmorrhages decide the nature of the epidemy. Hæmorrhages have often been observed in malarial fever, and more commonly in some seasons and epidemies than in others. A point of great importance with regard to these hæmorrhages is the occurrence of epistaxis as well as purpura and sponginess of the gums amongst the invalids at Netley who were undoubtedly suffering from malarial poisoning. Hæmorrhages are certainly very common in the course of relapsing fever; indeed more so than in ordinary cases of marsh fever. If we admit that the hæmorrhages and the sponginess of the gums *during* this epidemy were symptoms developing in the course of relapsing fever, to what, it may be asked, were due the epistaxis, sponginess of the gums, and purpura observed at Netley? Are we to suppose that they were the sequelæ of the relapsing fever from which the patients may or may not have suffered during the previous summer? This view cannot be rejected as impossible, but we know of nothing in the history of relapsing fever to support it. Sponginess of the gums has been observed in some epidemies of a genuine relapsing fever. It was a prominent symptom in the Yusufzie fever in India, described by Dr. Lyell in 1852. I do not think that there is the slightest reason for believing that the spongy gums observed in the Cyprus epidemy were the result of true scorbutus due to the want of green food. Veale states that the soldiers were supplied with plenty of grapes, and we know that soldiers are generally well fed and not liable to scurvy. This symptom was part of the epidemy itself, and

[1] Grall, *Archiv. de méd. nav.*, Tomes xlv., xlvi.

was no doubt one of the conditions favouring hæmorrhage. In the absence of any records of the pathological appearances in those who died, and in our ignorance as to the presence or absence in the blood of spirochætæ, no very positive opinion can be given as to the nature of this epidemy. I am satisfied that much of the fever of that year was malarial. From the character of the initial attack in many instances, its crisis, the relapses, the hæmorrhages, the sponginess of the gums, and, above all, the fact of the disease spreading in some instances on board ship in a way that suggests contagion, and from the extent to which the natives suffered, I think it probable that numerous cases of relapsing fever did occur along with malarious remittent.[1] I cannot say whether it is more probable that these cases in which dumb relapses occurred were malarial or relapsing. I am equally at a loss to pronounce upon the question, whether the general condition of the system, which was manifested by the sponginess of the gums, hæmorrhages, and purpura, was due to the malarious or to the relapsing fever, or whether it was not an independent cachexia. As it persisted after the relapsing fever had disappeared, and while only malarious poisoning appeared to remain, it might be argued that it owed its origin to the disease with which it ultimately remained associated. In this view the malarial epidemy would be conceived as having manifested or developed a scorbuto-hæmorrhagic cachexia. I use the term scorbuto-hæmorrhagic, not as designating a disease allied etiologically to scorbutus, but as a convenient name for a condition such as we have described—marked by spongy gums, purpura, and hæmorrhages from the mucous membranes.

This scorbuto-hæmorrhagic cachexia has been noticed in more than one epidemy of malarial fever. It would be going too far to assume that it was necessarily due either to the poison of malarial or relapsing fever. Another theory, and one for which much could be urged, is that it was a cachexia developed under unknown influences, and which aggravated the character of the fever or fevers with which it became associated.

The climate of Cyprus has proved much healthier than the experience of 1878 gave us reason to expect, the ratio per 1000 of

[1] Dr. Heidenstam, the chief medical officer of Cyprus, in a private communication to me says, "As to the fact that men suffered from those fevers who never left the ship, that is easily explained. Those ships were lying in roadsteads not far off from malarial foci, and consequently surrounded by a malarious atmosphere, and, further, used water from localities eminently infected with malaria. As regards hæmorrhages, although not always, it very often happens in cases of severe intermittent fever caused by hyperæmia, effusion of blood, or perhaps pigmentary obstructions of the circulation in different organs." Altogether, he is of opinion that the epidemy was purely one of malarial fever.

fever admissions, fever deaths, and invaliding from fevers, for the succeeding three years was as follows :—

	Fever Admissions per 1000.	Fever Death-rate per 1000.	Invaliding from Fevers per 1000.
1879, . . .	578·8	10·61	16·97
1880, . . .	219·0	0·00	0·00
1881, . . .	140·0	0·00	0·00

It will be seen from the above that while fever was frequent, pretty fatal, and severe during 1879, it was far less frequent in the two following years, and perfectly mild and harmless, the type being quotidian and tertian with little tendency to recur. The year 1884 was more unhealthy; this was ascribed by the medical officers to "the excessive rainfall of that year in a subsoil without drainage and in parts thoroughly water-logged" (*Army Medical Report*, 1884). The return for 1886 gives the ratio of admissions for malarial fever at 160·4 per 1000. No deaths were recorded for that year, and the invaliding from this cause was 1·57 per 1000.

The higher lands in Cyprus may be regarded as healthy, but what elevation is necessary to ensure immunity is unknown. The cantonment at Troödas, at a little over 5000 feet, is non-malarious. Larnaca, situated near salt lakes, is stated by Lefèvre (quoted by Lombard) to be particularly unhealthy, the fever in this locality often assuming a pernicious form. The appearance of the inhabitants is also said to be cachectic. Nikosia and Limasol are less affected. Heidenstam indicates the Potamia quarries, situated on the coast between Larnaca and Famagusta, as a specially feverish area. The two cases of the algid form met with by him during seven years both came from this locality. The choleraic form is also met with, but is not common. The comatose form is apparently more common.[1]

Continued or Remittent Fever.—The following is Heidenstam's description of the remittent or continued fever of Cyprus :—"This type is due to intense malarial infection, and is often met with in this island during epidemics of intermittent fever, especially towards the autumnal season; they greatly resemble in symptomatology intermittent fever, with the exception that instead of clear, there are simply slight and very often almost imperceptible remissions, and a sensation of chilliness and rigor generally precedes the paroxysm. The ana-

[1] The coma which terminates the febrile paroxysm is very similar to natural sleep, but of prolonged duration; and as the first attack is rarely fatal, this phenomenon is constantly considered by the friends of the patient as a salutary sleep, but in the second attack the patient sleeps never to awaken.

tomical appearances also do not differ from those met with in intermittent fever as far as the spleen and liver are concerned, but we, however, meet congestion in the brain, catarrhal and diphtheritic inflammation of the intestines, and sometimes even signs of hæmorrhage into the stomach and hæmorrhagic infractions in the lungs.

"The disease may be divided into three classes—mild, severe, and intense.

"The first or mild class sets in with a sudden feeling of oppression about the epigastrium, mental depression, headache, and a cold feeling down the back. These symptoms are soon followed by high fever, flushing of the face, the skin being very hot and dry, the temperature rises to 103° or 105° F., the pulse is small and full, from 120 to 130, the tongue is furred and dry, the spleen is enlarged and mild jaundice is observed, the bowels are irregular, the fæces discoloured, and bilious matter is often vomited. A most particular symptom, which I have never failed to meet in cases of remittent fever, is a buzzing noise in the ears. At the commencement of this form of fever there exist irregular exacerbations, which become more and more regular, and are subsequently followed by clear remissions generally occurring in the morning; the symptoms gradually decrease, perspiration sets in, and the patient recovers. This course lasts from a few days to three weeks.

"In the second, severe class, the remissions are only slightly marked at the invasion, all the symptoms of the previous form are aggravated, the patient becomes delirious and stupid, the disease lasts from eight to twenty-one days, and sometimes more, and if it ends in recovery it usually assumes an intermittent type. If death results, it is generally sudden, with symptoms very analogous to typhus fever.

"The third, intense class, has a striking similarity to typhus fever of a very adynamic character. . . . The spleen and liver are considerably enlarged, epistaxis and hæmaturia are often noticed, and sometimes suppression of urine or albuminuria. Inflammatory exudations not unfrequently form in the serous membranes or lungs; towards the second week, petechiæ are met with on the skin, the patient soon falls into a deep apathy, which is followed by collapse."

Enteric Fever is prevalent among the civil population, and a certain number of cases occur among the troops.

Typhus Fever was stated by Fracastori, in the earliest description extant of the disease,[1] to be a malady indigenous in Cyprus and the neighbouring islands, but I have met with no recent accounts of its existence in the island.

[1] *De morbis contagiosis*, Venet, 1584, 87.

Dysentery prevails to a considerable extent in the plains, but the disease is usually of a mild type.

Diarrhœa is one of the commonest diseases in the towns during the warm season, and causes a considerable infantile mortality.

Acute diseases of the *Respiratory organs* are exceedingly rare, and *Phthisis* is only moderately common.

Rheumatic Diseases do not prevail to any large extent; and although *Rheumatic Fever* is met with, it is of less frequent occurrence that in Western Europe.

Syphilis is widely diffused among the population of the towns, but is generally of a mild type.

Leprosy.—At the time when the British occupation began, it was calculated that 33 out of 667 villages were infected with leprosy; the number of lepers at that period being estimated at 150. The greater number of cases come from the low-lying villages in the district of Famagusta. It is rarely met with amongst the Mussulman population. The sore known as the *Aleppo Boil* is frequently seen on the island.

CHAPTER IV.

ANATOLIA (ASIA MINOR), ARMENIA.

GEOGRAPHY.—Anatolia and Armenia extend from the Ægean Sea to the borders of Persia, and from the Black Sea on the north to the Mediterranean Sea, Syria, and Mesopotamia on the south. Together they constitute a vast plateau, rising to a height of from 2400 to 7000 feet above the sea, surrounded along the coasts by a belt of low land of varying breadth. In some places the mountains abut on the sea; in others, wide and fertile plains stretch between the sea and the high lands. Even where the coast line is narrow, the river valleys extend for some considerable distance inland.

The table-land is bounded on the north by a more or less continuous range of hills running parallel to the Black Sea. These are in many places covered with forest. On the south, along the Mediterranean, is the Taurus range, which attains altitudes of from 8000 to 12,000 feet. On the west, along the Ægean and the Sea of Marmora, the mountains are more detached, and run perpendicularly to the coast line.

The table-land thus bounded is generally bare and treeless, presents extensive grassy plains, and naked tracts covered with an incrustation of salt, with numerous salt and fresh water lakes and marshes.

The principal lakes in Anatolia are the Tuzla Gol, the Bei-sher, and the Egerdir in the interior. Lakes Maniyas, Abullonia, and Isnik are found at some little distance inland from the Sea of Marmora. The largest sheet of water in Armenia is Lake Van, which has a length of 80 miles, and is 50 miles broad. It is a salt lake.

The rivers running into the Black Sea are the Yeshil-Irmak, the Kizil-Irmak, and the Sakaria. Into the Ægean flow the Sarabat (Hermus) and the Mendereh (Mæander). No river of any note falls into the Mediterranean.

The population of Anatolia is estimated at about 5,000,000, and that of Armenia at about 2,000,000.

CLIMATOLOGY.—The climate of the higher parts of the plateau is extreme. The summers are excessively hot, the winters very cold and prolonged. Snow lies on the table-land of Armenia up to June. The climate of the coasts of the Black Sea is milder than that of the high lands, but here, too, the summer temperature is high. Winter is the rainy season, the summers are dry.

The annual mean temperature of Trebizond on the Black Sea is 18°·5 C.; that of January, 6°·8; of April, 12°·2; of July, 24°·3; and of October, 15°·5 C. Smyrna, on the Ægean coast, has a mean annual temperature of 18°·7 C.; that of January, 8°·2; of April, 14°·6; of July, 26°·7; and of October, 16°·9 C.

At Erzeroum, in Armenia, at an altitude of 1591 mètres, the monthly mean temperature, according to Lombard, is as follows:—

January,	−7·78	July,	22·28
February,	−3·56	August,	22·78
March,	1·39	September,	16·89
April,	9·28	October,	10·89
May,	11·06	November,	3·17
June,	18·78	December,	−4·94

PATHOLOGY.—*Malaria.*—Malarial fever is endemic all along the Mediterranean. Ague and remittent fever prevail at Besika Bay (*Navy Report*, 1878). Inland from this bay, on the plains of Troy, malaria is common, and is sometimes epidemic after heavy rains, as was the case in 1870 (Lombard). Dr. Schliemann's excavations had to be suspended for a part of the year on account of malarial fever, which appears to have been rendered more intense by the disturbance of the soil. During the Crimean War, Parkes witnessed its frequency here, and observes, that "on making some inquiries of the inhabitants of the highly malarious plains of Troy, I found the villagers universally stated that those who drank marsh water had fever at all times of the year, while those who drank pure water got ague during the later summer and autumnal months."

The shores of the Sea of Marmora and the coasts of the Black Sea are severely affected with malaria. At Trebizond and Sinope, fever is extremely frequent. According to Hell, those parts of the country near the Black Sea suffer most where the forests descend to the sea, but no part is entirely exempt from fever.

The high plateaux of the interior enjoy only a relative immunity. Fever is met with at altitudes of 4000 feet, or perhaps even higher. Ague exists along the shores of Lake Van, and in the upper course of the Tigris and its tributaries. At Bitlis, a short distance south of Lake Van, after passing through a rugged country with numerous

rivers and streams, Layard's party was for the first time during the journey visited with that curse of Eastern travel, "fever and ague."

At the higher elevations, the fevers are of the intermittent type, and mild in character; but remittents as well as intermittents of a more severe form are met with at the lower levels, especially along the borders of the lakes which become partially desiccated in summer. According to Tchiatcheff, the fever attains its maximum in Asia Minor in the month of September, a minor rise taking place in spring (Rey).

Typhoid Fever.—Although our accounts of this disease are scanty and confused, they leave us in no doubt as to its endemic existence in Asia Minor; we are unable, however, to estimate its comparative prevalence in different parts of the country. *Typhus Fever* was introduced into Trebizond, Samsoon, and other parts of Asia Minor in 1863 and 1864 by Circassian immigrants from the Caucasus, but the disease is not endemic in the country.

Hirsch is of opinion that *Bilious Typhoid* is the disease referred to as "Levant fever" and "Smyrna fever." The typhus complicated with jaundice, which has been observed at various times at Smyrna, is probably of this nature. *Cerebro-spinal Meningitis* was observed at Magnesia in 1869, and at Smyrna in 1870.

Diphtheria, which appeared at Smyrna for the first time in 1865, has since that date raged disastrously in many places in Asia Minor (Hirsch).

Cholera reached the northern and southern confines of Asia Minor in the years 1822–23, but did not then invade the country. The disease was introduced into Smyrna in 1831, and on this occasion, again, it does not appear to have made its way into the interior; but in 1848 and in 1853–56, cholera became widely diffused all over the country. Trebizond, Samsoon, Sinope, and some parts of Armenia were visited during the epidemic of 1865, but the country generally escaped during this outbreak.

Dysentery may be regarded as endemic in Asia Minor. It is met with along the coasts, especially in Adana; and it is also prevalent in the valleys of the Anti-Taurus and on the table-land.

Diarrhœal diseases are common in all parts of the country.

Bronchitis and catarrhal affections are signalised as specially prevalent on the high table-land of Armenia, and *Pneumonia* as of frequent occurrence on the plains of Troy.

Phthisis is common in the large cities, but is seldom seem on the Armenian plateau, where, according to Wagner, it is seen only in persons who have migrated from other countries.[1]

[1] Wagner, *Reise nach dem Arrarat*, Stuttg. 1848, quoted by Hirsch.

Syphilis is by no means rare in the seaport towns of Asia Minor; but we have no accounts respecting the extent to which it prevails in the interior, with the exception of Armenia, where it is reported to be unusually frequent.

Scrofula is a common disease throughout Asia Minor.

Leprosy is only met with in isolated cases in Smyrna, and at some points on the coast of the Black Sea.

Goitre and *Cretinism* occur endemically, according to Hirsch, only in one or two localities. These are "at Bolat, in the valley of the Kulschuk-Mender, in the neighbourhood of Aidin, in Marsovan, in the upper valley of the Euphrates (north-east of Arabkir), and in Egin."

CHAPTER V.

SYRIA.

Geography.—Syria is bounded by the Taurus range on the north, on the south by Arabia, on the east by Mesopotamia, and on the west by the Mediterranean.

The northern provinces of Adana (politically a part of Anatolia) and Aleppo are traversed by mountains running from north to south, which are offsets from the Taurus range, and are continuous in the south with the Lebanon and Anti-Lebanon chains, which enclose Cœle-Syria and bound the valley of the Jordan. The Dead Sea, the Sea of Galilee, the Lakes of Damascus, into which flow the Abana and Pharpar, and the Sabaka to the south-east of Aleppo, are the only lakes of importance in this province.

The Dead Sea is especially remarkable. It is 40 miles long, by an average breadth of 9 miles, and is 1312 feet below the level of the Mediterranean. Its southern shores are low, level, and marshy.

The soil of Syria is generally rich wherever water is abundant, but towards the east the country is a dry and parched desert.

Climatology.—The mean annual temperature of Beyrouth, on the coast, is 20°·6 C.; that of January, 12°·9; of April, 18°·7; of July, 27°·8; and of October, 24°·2 C. Rains are rare between the 15th of June and the 15th of September.

Jerusalem, at an altitude of 2670 feet, has a mean temperature of 17°·2; that of January, 8°·5; of April, 14°·5; of July, 24°·5; and of October, 20°·8 C. At Aleppo, on the border of the desert, the mean temperature of the year is 17°·6; the winter temperature is 6°·3; and that of summer, 27°·2. The climate of Aleppo is very dry.

Pathology.—Adana, on the great Cilician plain in the northern part of Syria, is highly malarious, especially along the course of the Tersûs Chai, of the Sihun, and of the Jihun. The evil is augmented in respect to the country traversed by the first of these rivers, by the fact that it is liable to overflow. The coast line here is marked

by sand hills about ten feet high, and by lagoons and marshes fringed with reeds and cane-brakes. There are also two large marshes, one south-west of Tarsus, the other five miles south-west of Adana. On the banks of the Jihun there is a Noghai settlement. After the Crimean War about 20,000 Noghai families left Russia and took up their abode on this plain. Now, barely 2000 families remain. This shows how powerfully malaria dominates this once healthy region.[1]

The inhabitants of Tarsus and Alexandretta take refuge during the summer months in the neighbouring hills to escape fever. The plain of Antioch is unhealthy; the coast towns, Tyre, Acre, and Jaffa, all suffer more or less. At Tripoli fevers are very frequent, and this is ascribed to the fact that a stream from Lebanon runs through the town, causing humidity of the soil.[2] The hilly regions are healthy; but the inland districts, although at an elevation of from 500 to 2000 feet, are not free from fever. At Jerusalem, from a quarter to one half of the admissions into hospital are for fever. The intermittent and bilious, or gastric remittent forms, are all met with. Damascus, at an elevation of about 2260 feet, suffers from intermittent fever from August until the cold season sets in. Aleppo is healthy; and, according to Barret, Beyrouth is free from malarial fevers.

Typhoid Fever is of frequent occurrence at Jerusalem and Damascus, and also, although less frequently, at Beyrouth. March, April, and May are the months when it is most prevalent.

Typhus has occasionally been observed in an epidemic form, but it is not endemic in the country, so far as is known.

A few cases of epidemic *Cerebro-spinal Meningitis* were observed in Jerusalem in 1872.

Plague was formerly a frequent visitor in Syria. Hirsch reckons that thirteen outbreaks occurred between 1773 and 1843. Since the latter date the disease has not been observed in Syria.

Diphtheria and *Croup* are met with, but we do not know to what extent they prevail.

Asiatic Cholera has repeatedly invaded Syria.

Dysentery, Diarrhœa, and *Gastro-Enteritis* are prevalent diseases, constituting from one-fourth to one-sixth the admissions into the

[1] Wilson, *Proc. Roy. Geog. Soc.*, June 1884.

[2] Rey makes this statement in his article "Géo. Méd." (*Nouv. dict. de méd. et chir.*, tome xvi. p. 221); but it should be remarked that Barret (*Archiv. de méd. nav.* 1878) says that intermittent fever is very rare at Tripoli, is more frequent at St. John d'Acre, and rages with force on the north part of the coast, notably at Mersina and Alexandretta, where pernicious cases occur in autumn.

hospitals at Jerusalem; they are also of frequent occurrence in Damascus, Beyrouth, and Aleppo (Lombard).

Smallpox.—From the general neglect of vaccination, smallpox is frequently epidemic in Syria, and causes a high mortality.

Measles often makes its appearance, but *Scarlet Fever* is seldom seen.

Phthisis is rare at Beyrouth, where it follows a slow course; nor is it at all a common disease at Jerusalem. It is more frequent in the Lebanon, and is said to be endemic at Baalbec and Aleppo.[1]

Bronchitis and *Pneumonia* are frequently met with in Jerusalem. Pneumonia is rare at Beyrouth, but is much more common in the mountainous parts of Syria.

Hepatic diseases are by no means rare; but *Abscess of the Liver* is only occasionally seen.

Rheumatism is one of the common diseases of the country, and *Rheumatic Fever* is not unfrequently met with. Yates treated 429 cases of rheumatism at the British dispensary at Beyrouth (1842–43) out of 4298 patients.

Leprosy prevails to a considerable extent in the valleys of the Lebanon and Anti-Lebanon. Considerable numbers of these sufferers, from all parts of the country, congregate at Jerusalem. The sea-coasts are but little affected.

The *Aleppo Boil* is met with not only in Aleppo, but also at Alexandretta, and in many other localities in the north-west of the province of Aleppo.[2]

Syphilis is moderately diffused throughout Syria.

Scrofula is seen in all parts of the country among the poorer classes, but is decidedly rare in the mountainous districts.

Rickets are also by no means rare.

Amongst the prevailing diseases of Syria have to be named *Conjunctivitis*, simple and purulent, and eye affections generally.

Anæmia, according to Barret, is a frequent disease at Beyrouth.

[1] Guys, *Statist. du Paschalik d'Alep.*, Marseille 1853, quoted by Hirsch.
[2] Fox and Farquhar, *On certain Endemic Skin Diseases*, London 1876.

CHAPTER VI.

MESOPOTAMIA AND KURDISTAN.

Geography and Climate. — Mesopotamia comprehends not only the valley of the Tigris and Euphrates, but the whole region bounded by the Zagros Mountains and Kurdistan on the east, and by the Syrian desert and Arabia on the west. On the north is Armenia, on the south the Persian Gulf.

The northern districts of Diarbekir and Kurdistan, bordering on Armenia and Persia, are mountainous; the rest is a plain, which, except near the banks of the rivers, is covered with verdure only during the rains. This region, the seat of ancient empires, and once one of the richest and most populous parts of the world, is to-day in many parts barren and desolate. Layard tells us that "the greater part of the country below the site of ancient Babylon has been for centuries a great swamp. Another extensive swamp is formed by the Euphrates above its confluence with the Tigris at Korna, and these swamps are yearly increasing in extent,[1] so as to threaten to cover the whole of southern Mesopotamia."

The province of Bagdad, comprising the greater portion of the basin of the Lower Euphrates and Tigris, has an estimated population of 4,000,000; that of Diarbekir has about 700,000 inhabitants. The population of the city of Bagdad is variously estimated at from 60,000 to 180,000; that of the town of Diarbekir numbers about 40,000. The former is liable to inundations; the latter presents numerous stagnant pools, which are supposed to render it unhealthy.

The climate of the mountainous districts differ little from that of Armenia. As we descend to the plains the temperature increases; the winters especially become shorter and more temperate. The following, according to Hann, are the temperatures at Mosul and Bagdad:—

	Jan.	April.	July.	Oct.	Year.
Mosul, . . .	7·0	15·4	34·1	22·4	20·1
Bagdad, . .	9·7	23·1	34·9	24·8	23·3

[1] Layard's *Discoveries in the Ruins of Nineveh and Babylon*, London 1853.

At Bassorah, on the Shat-el-Arab, nearer to the Persian Gulf, the temperature is still more oppressive. The rainfall throughout this region is scanty. For the Mesopotamian plain, Colville gives it at 18–25 inches. The rainy season being the months of December, January, and February.[1]

Schlæfli, calculating upon 10,509 deaths occurring at Bagdad between 1853–62, found that the four seasons range themselves, as regards mortality, in the following order:—

Summer.	Spring.	Autumn.	Winter.
23·8	24·76	25·26	26·18

PATHOLOGY.—*Malaria.*—No part of Mesopotamia is free from malaria, which may be regarded as the dominating element in the pathology of this region. At Diarbekir fever is prevalent. Mosul, situated on an elevated position on the right bank of the Tigris, is the prey of remittent fever in summer, and of intermittents in winter. Bagdad is highly malarious. Hyslop informs us that "in the hot season of 1834, the town suffered very much from intermittent fever; a circumstance," he says, "never known before, but easily accounted for by the vast number of marshes left all around the city by the late overflow of the Tigris. In 1836, the mortality, in a population of 75,000, exceeded sixty a day from bilious-remittent fever, the weather then being hot and oppressive. From that time to 1840 intermittents were prevalent every autumn. The overflow of the river in March and April 1849 was followed in the middle of June by a great mortality from fever, dysentery, and diarrhœa. In 1850, fever again prevailed to as great an extent as in the former year. The fever of 1849 is stated to have been accompanied by bilious vomiting and intensive headache. When it proved fatal, it generally did so by ending in coma. In the beginning of the epidemy no cold stage was observed, but as it progressed this stage became more marked, and at last the ague was the worst part of the fever."[2] Hillah and Samareh are comparatively healthy.

After the junction of the Tigris and Euphrates, the united stream takes the name of the Shat-el-Arab. The entire course of this river, the country through which it flows, and its delta, form one of the most malarious regions anywhere to be found, especially those districts liable to inundation. Mr. Ives, who visited this district in 1758, says that he "was informed that the Arabs had broken down the banks of the river near Bassorah with design to cover with water the deserts in the neighbourhood—an act of

[1] *Trans. Epidem. Soc.* 1875–80.

[2] Hyslop, *Trans. Bombay Med. and Phys. Soc.* 1849–50, and 1853–54.

barbarity causing general sickness."[1] Evatt, writing in 1875, states that "Bassorah is decimated by malarious diseases,—every man in Bassorah has ague." The fever is often of the pseudo-continued form, with liver and spleen complications. As proving the intimate relation between soil-conditions and malaria, it is to be noticed that the heights round Bassorah are healthy. The years of heavy rainfall are specially feverish. The saying is, and it is certainly true for miasmatic fevers, "the hotter the season the healthier it is." A great fall of snow on the hills is accompanied by a great fall of rain on the plains; and to an unusual fall of rain, more than to inundation, is increased sickness due (Colville).

Enteric Fever has been observed at Bagdad. It was epidemic among the Kurdish prisoners in 1855 and 1857. It has also been noticed at Suleimanyeh in Kurdistan, to the east of Mosul (Lombard). Evatt signalises the frequency of fevers of a low type in Bagdad, which may probably be taken to include *Typhoid Fever.* (*Army Medical Report,* 1874).

Typhus was observed at Mosul in 1854, and at Suleimanyeh in 1855. Typhus is probably endemic in Turkestan and in the basin of the Euphrates and Tigris. Dr. Schlæfli signalises the frequency of simple and membranous sore throats, from which we may conclude that *Diphtheria* is not unknown.

Cholera is a frequent visitor in Mesopotamia. Evatt reckons that Bagdad had suffered from thirteen outbreaks during the preceding forty years.

Dysentery and *Diarrhœa,* as we have seen, are occasionally epidemic in Bagdad. Floyd's observations[2] seem to point to the prevalence of dysentery in Bagdad, but Hyslop says that it is not common. Our information respecting other districts is vague, but we gather from general references that dysentery, both as an independent disease and as a complication of malarial fever, is widely diffused over the Mesopotamian plain, and that it is most fatal in the warm season.

Cholera Infantum is also signalised as of frequent occurrence during the summer months.

Smallpox was observed by Dr. Schlæfli in Mesopotamia in 1854, 1856, 1857, 1858, 1859, and 1860. Evatt, in 1875, states that it is of frequent occurrence in Bagdad. Smallpox thus appears to be, to a certain extent, endemic in this region.

Measles and *Scarlet Fever* prevail from time to time, but do not appear to exhibit any special malignancy.

Whooping-Cough is met with from time to time in an epidemic form.

[1] Lind's Essay, London 1768. [2] Floyd, *Lancet,* July 1843.

Plague is endemic in Mesopotamia, and has been so for ages. A terrible visitation of plague is said to have occurred at Bagdad in 1715, another severe epidemy occurred in 1772, and other severe outbreaks were witnessed in 1800–2 and 1831–34, on which latter occasion the disease is said to have caused great havoc in the city. From 1856 down to 1885 (which is the latest date for which we have trustworthy data) plague has never been absent from the country, shifting from one place to another. Irak Arabi, the ancient Babylon, Hillah, and Bagdad have all suffered, but not more than the smaller towns. During these outbursts some villages have lost more than a third of their inhabitants.[1]

Pneumonia and *Bronchitis* are by no means rare in Mesopotamia during the winter season.

Phthisis is seldom seen at the higher altitudes, but Dr. Schlæfli [2] states that *Tuberculosis* is by no means rare among the natives of the plain, and that strangers also contract the disease.

Scrofula, *Rheumatism*, and *Ophthalmia* are mentioned by Floyd as diseases affecting the natives of all classes in the delta of the Euphrates.

The *Aleppo Sore* is endemic throughout the country.

Leprosy is said to exist in Mesopotamia, but I have met with no data to enable me to form any estimate of its prevalence.

[1] Mahe, *Archiv. de méd. nav.* tome xliv. Colville, *Trans. Epidem. Soc.* 1875–80.

[2] Schlæfli, *Zur physikalischen Geographie von Unter-Mesopotamien*, Bagdad 1862, quoted by Lombard.

CHAPTER VII

ARABIA.

Geography.—The peninsula of Arabia is situated between 12° 40′ to 34° N. lat., and between 32° 30′ to 60° E. long. Its greatest length, from north-west to south-east, is about 1800 miles; its mean breadth, about 600 miles. Its area is 1,230,000 square miles, with an estimated population of about 5,000,000.

The interior of Arabia consists of a vast plateau, from 2000 to 7000 feet above the sea-level. An Alpine chain (serat), whose peaks form a crest from 8500 to 9800 feet in altitude, extends all along its west side from the extreme south to Syria. The southern edge of the peninsula is likewise formed by a mountain mass, which sends out its spurs as far as Muscat on the east. The interior is in its central part furrowed by numerous streams or torrents which contribute their scanty waters to the Wady-el-Dawāsir. The Nejid plateau to the north contains a scattered population living in the valleys and oases where water is obtainable. To the south extend the elevated Dahna deserts. But whilst the interior is arid, and but sparsely populated by nomadic tribes, the costal fringes are rich, productive, and well cultivated.

Aubert Roche[1] describes three terraces on the western side of the peninsula, rising one above the other. The lowest of these is subject to inundations, and is alternately submerged and left dry by the sea, or as a result of the rains; the second occupies the middle zone, and is consequently free from this source of danger; whilst the third is situated at the higher elevations.

Climatology.—All along the coast the temperature is very high. At Hodeida the thermometer frequently rises to 104° F. Its minimum record in the coldest month is 57° F. At higher elevations the heat is less oppressive; but even at Sana (7284 feet) 93° F. are often registered in the hottest season; and in

[1] *Ann. d'hyg. publ.* vol. xxxi. 1844, p. 26.

winter, although ice is formed during the night, yet the thermometer registers 68° F. after noon.

In the mountainous districts there are two periodic rainy seasons—a minor one in March, and a major one in July, August, and September.

PATHOLOGY.—*Malaria.*—The western, southern, and eastern coasts of Arabia, with the exception of isolated localities, are malarious, and the infection, which extends for some distance inland, reaches considerable elevations. The lowest of the three terraces mentioned above is the most unhealthy; the second less so; but it is only when we reach the third or highest terrace that the climate becomes entirely healthy.

Yembo, Jeddah, Konfodeh, Lohei, Hodeida, and Mocha, along the west coast, are all affected in different degrees. Malarial fevers prevail with great intensity, and sometimes in an epidemic form, at Medina. This is ascribed to the marshes which exist in the environs of the city. Mecca is more healthy; but even here fevers, supposed to be of malarious origin, occur. The whole central plateau, "comprising the space occupied by Djebel-Toweyk on the east, Wadi Dawāsir on the south, the desert margin of Hajj or pilgrim route to the west, and the Nefood above Djebel Shomer to the north, with whatever lies within these four limits, is one of the healthiest of countries." Palgrave says, "Of intermittent fever, though I heard of it, and witnessed one or two cases, I should say that it is extremely rare."[1]

Typhoid Fever is not unknown along the coast line. Courbon says that it is met with at Jeddah, although it is rare. Perhaps it will be found to be more frequent than is at present supposed. Typhus and typhoid fevers, according to Palgrave, are wholly unknown throughout the Nejid, taking that term in its widest geographical acceptance.

This writer, however, states that a remittent fever of a simple type, milder than the remittent of India, which soon yields to tartarised antimony in small but repeated doses, exists here and there throughout the Nejid. If improperly treated, it may drag on for two or three weeks. This seems to be similar to the fever observed by Peters at Muscat.

Plague was destructively epidemic along the west coast in 1815 and 1832. On the former of these occasions it was estimated to have carried off about a sixth of the population of Jeddah and Mecca. It again showed itself in the mountainous district of Assir in 1853, 1874, and 1879. From this centre, on all of these occasions, it invaded considerable, but imperfectly defined tracts.

[1] Palgrave, *Journey through Central and Eastern Arabia*, Lond. 1865.

Cholera.—Zacutus Lusitanus, writing in 1629, notices the existence in Arabia of the disease known in India as Mordeshi, which was undoubtedly epidemic cholera.[1] In recent times Arabia has suffered from frequent outbreaks of this disease. Cholera appeared at Muscat in 1821. The coasts were invaded in 1831, 1835, 1846–48, 1859, 1864–65, and 1871–72. The pestilence was introduced from India in 1864. In May 1865 it broke out among the pilgrims in Mecca, by whom it was diffused through Egypt, from which it extended to Europe and America. The disease has penetrated into the central districts. El Haïl, the capital of the district of Djebel Shomer in the inland provinces of Nejid, was attacked in 1871, although in former epidemies this district appears to have been spared, even when the low isolated valley of the Djowf suffered severely (Palgrave).

Dysentery is widely prevalent along the coasts, but is of less frequent occurrence in the interior.

Smallpox has been endemic in Arabia from time immemorial, and is propagated by the practice of inoculation, which is still in use in the Nejid. The prejudices of some of the tribes prevent the adoption of vaccination.

Measles is known, but is neither frequent nor severe.

Scarlet Fever also exists, but it does not appear to be a common disease.

Pneumonia and *Bronchitis,* rare on the coasts, are common enough on the plateau.

Phthisis, according to Palgrave, is rare on the Arabian plateau. On the shores of the Red Sea the settled Arabs suffer to a considerable extent from the disease. What Palgrave calls abdominal phthisis is common in the interior. From the fact that this malady does not appear to have been peculiar to infancy and childhood, other diseases than tabes mesenterica are perhaps indicated or included.

Scrofula, affecting the glands of the neck, and rachitis producing distortions, are often seen in the southern Nejid, but are rare in Shomer, Kaseem, and Sedeyr.

Rheumatism, of all possible forms, is common among the Bedouins and the poorer villagers, and cardiac affections are not at all rare.

Cancer seems to be practically unknown.

Syphilis, called *Belegh,* is "frightfully common." Palgrave says that the disease is supposed to be communicable from one to another in no less comprehensive a way than smallpox and scarlet fever; and he adds that he saw cases that hardly admitted any other explanation.

[1] *Trans. Epidem. Soc.* vol. iii.

Ophthalmia is one of the commonest maladies of Arabia.

Two points on the peninsula demand more detailed consideration, viz. Aden and Muscat.

ADEN.

TOPOGRAPHY AND CLIMATE.—The peninsula of Aden is 15 miles in circumference, and is joined to the mainland by a narrow isthmus about 3 miles in length. It consists of a mass of volcanic rocks destitute of vegetation, except where the furrows made by the occasional rains show a faint trace of green. The population is confined to two localities—Steamer Point, and the Crater or Camp where the native town is situated.

The shores of Aden Bay are left exposed at low tides. Swampy ground exists at the further extremity of the isthmus, and large salt marshes near the shores of the bay.

At Steamer Point the soil along the shore is sandy; but this sandy fringe is quite narrow, terminating in bare rocks upon which are built the barracks and houses of the officials and wealthier merchants. The greater number of the houses, however, are built along the sandy shores. The Crater is a sandy hollow, encircled by a high wall of bare volcanic rocks. The water supply is derived from four sources: 1. An aqueduct from the mainland; 2. Condensed water; 3. From the enormous tanks that form one of the sights of Aden; 4. From wells which have a considerable depth and yield a brackish water.

Water from the aqueduct is sold at two pies per gallon; that from the tanks at one and a half pie. The humidity of the air is at times excessive, rendering the outside stairs of the buildings as wet as if they had been watered. Carts pass round and remove the night-soil, which is burned.

The town within the Crater is protected by its perpendicular wall of rock from infection which might be carried by the winds from without. The very rare, scanty, and irregular rainfalls must be rapidly absorbed by the sandy soil, and nothing in the nature of a marsh, temporary or permanent, exists within the Crater. A population of twenty to thirty thousand must always, however, require a considerable daily water supply for domestic purposes; and in Aden the waste water is thrown out into the sandy paths that serve for streets. This soakage of liquid impurities is, so far as I can see, the only source of moisture to give rise to malaria, if, indeed, this infection is really endemic in the Crater, which I doubt. At Steamer Point we cannot, it is true, exclude the possibility of miasm arising

from the foreshores and from the swampy lands and salt marshes in the neighbourhood.

So much for the physical conditions of the soil at Aden, which certainly appear little favourable to the development of malarial fever.

The following table gives the temperature, rainfall, and humidity at Aden, along with the monthly fever admissions per 1000 of the European troops, 1839–45 (Webb).[1]

It must be remembered that the troops which garrison Aden have previously served in the malarious Presidency of Bombay.

	Mean Tempera-ture.	Average Rainfall.	Hu midity.	Fever Admissions per 1000 of strength.	Fever Deaths per 1000 of strength.
January, .	74·9	0·53	70	26·902	—
February, .	75·9	0·48	70	22·148	—
March, .	78·6	0·15	70	30·475	0·284
April, .	81·5	0·39	67	43·198	0·568
May, .	84·9	0·28	69	61·388	1·147
June, .	86·7	0·00	65	74·796	1·746
July, .	84·7	0·02	67	51·371	0·875
August, .	84·7	0·11	66	19·446	0·273
September,	86·3	0·00	64	26·878	—
October, .	81·8	0·00	63	82·407	2·439
November,	77·2	0·16	66	33·881	0·505
December, .	75·6	0·24	70	26·953	0·272
Totals and Means,	81·1	2·36	67·3	499·843	8·109

Pathology.—An examination of this table will show that the fever curve at Aden exhibits two maxima and two minima. The maxima occur in June and October, the minima in February and August. The fever admission-rate rises steadily from March to June along with the increasing temperature and the decreasing humidity of the atmosphere; it begins to fall again, however, in July, and in August and September the admission-rate is low, and this notwithstanding the persistence of nearly the same conditions of temperature and humidity; the fever admission-rate rises rapidly in October,—a month during which there is a decided fall in the temperature with the minimum of humidity. This rise is a sudden and temporary one, for in November the fever admissions diminish greatly, and during the cool season—November to March—the fever admission-rate remains low.

The first rise in the fever rate, from March to June, being constant and steady, is probably connected with the steady increase in temperature during these months. But that the high tempera-

[1] *Trans. Bombay Med. and Phys. Soc.* 1851–52. For the month of January the average is for three years only, viz., 1840, 1841, and 1842.

ture is not the sole cause of the evolution of fever, is evident from the great fall in the admission-rate in August, when the temperature is still high, and by the second rise in October, when the temperature has considerably fallen. Do these two rises depend on two fevers, or on two forms of one and the same fever? In October malarial fever is most prevalent in these latitudes, and we may conjecture that the second maximum is owing to relapses of malarial fever, brought on by the falling temperature. We shall see, as we proceed, that in Muscat, as in Aden, these two maxima appear, and about the same time, which points to the conclusion, that whatever may be its true explanation, this curve corresponds to something real in the pathological evolution of the seasons.

We shall now try to ascertain the general features of the pathology of this remarkable spot, and the nature of the fever met with in this domain of burning rock and sand.

Mr. Steinhauser, Civil Surgeon, in his report on Native and General Hospitals, Civil and Military, for 1853 and 1854,[1] says: "The chief diseases, taking them numerically, treated during the past year at both hospitals have been fevers, ulcers, rheumatism, diarrhœa, dysentery, and scurvy, all of which affections may be considered as prevalent at Aden. Fevers are of daily occurrence during the entire year, and cannot be said to prevail at any given season. During the months of June and September the admissions were, in the past year, most numerous. The total number of fevers treated have been 505. The casualties under this head are five in number—about 1 per cent. of the treated. Fever as it presents itself at Aden is not a very formidable disease. Among the Europeans it mostly assumes the bilious-remittent type—intermittents being uncommon. . . . The moist, hot climate of this part of Arabia appears ill adapted for convalescents from any disease. Among the native population fever presents itself as a quotidian intermittent, or in the common continued form, accompanied by much derangement of the chylopoietic organs." It must be observed that in the civil hospital sailors and others, who may have contracted the disease elsewhere, are treated. We do not know what proportion of these treated belong to this class. It is a question, too, whether the natives who suffer from intermittents contracted them in Aden or in the environs, which, as we have seen, contain marshy localities. It may, however, be regarded as possible that some of the cases of intermittent fever occurring among the native population were contracted on the peninsula. But, considering the large population, permanent and floating, it must be conceded that

[1] *Trans. Bombay Med. and Phy. Soc.* 1853–54.

Aden is by no means a feverish locality. This is confirmed by the following statement by Dr. Edkins:[1] 'The most important disease that occurs at Aden among Europeans is shown to be continued fever. It appears to be caused by the ardent heat of summer; and those who arrive at the beginning or during the course of the hot season are more predisposed to these attacks than others. There was only *one* admission from intermittent fever in the year 1862 in the wing of the 4th Regiment, while in 1860 there were 237, and in 1861 there were 54.' This shows, as Dr. Edkins remarks, how completely the miasmatic poison, which affected the troops when in Gujerat, their previous station, had disappeared, and how free Aden is from such malaria.

It may thus be concluded that Aden is only slightly affected with malaria, but that a continued fever of some sort is rather common.

Some additional light is thrown upon the nature of fever in Aden by the following extract from the *Navy Report* of 1878. In the *Undaunted*, 125 cases of simple continued fever occurred in the end of May. This, it will be observed, is the period when the first rise, culminating in the June maximum, takes place. The symptoms of this fever are thus described: "Headache, vertigo, heat of skin, thirst, loss of appetite, watchfulness, and constipation. The patients appeared languid; the conjunctivæ were injected; skin hot and dry; the tongue furred. Pulse, 90 to 110; temperature, 101° to 103° F. A difference was observed in the symptoms exhibited by the deck hands and those employed below. In the first, the temperature was highest at the commencement, the fur on the tongue was thin, defervescence was rapid and convalescence short. In the second, the temperature on admission was only a degree or two above the normal standard; it gradually rose, however, and remained at 102° to 103° for several days. The fur on the tongue was thick and brown. The convalescent stage was prolonged; greater exhaustion ensuing. The average term spent on the sick list by each patient was between seven and eight days. For three months prior to this outbreak the ship had been moored in the Aden harbour, and during the latter part of this time the men had generally complained of an indisposition to eat. They cared for nothing but fluids, and suffered from sleeplessness. There was also a general indisposition to go ashore."

This is no singular instance of fever of this kind contracted here. Simple continued fever, in fact, is of frequent occurrence amongst the men of the ships of war that visit Aden. The average time during which cases of this form of fever remain under

[1] *Army Medical Report*, 1862.

treatment is four or five days (*Navy Report*, 1887). As we do not read of this fever having been followed by attacks of the intermittent type, or of the patients developing other signs of malarious infection, it may be concluded that the fever was of climatic origin. For just as exposure to cold, in certain conditions of the body, is capable of inducing catarrh of the air passages with the catarrhal fever proper to the same; so exposure to a continuous high temperature is, in certain circumstances, capable of inducing catarrh of the alimentary canal and congestion of abdominal viscera, accompanied by a catarrhal fever proper to the same. There is a fever *a frigore*, and a fever *a calore*. Both are symptomatic, and depend on catarrhal or congestive processes induced by temperature. Heat probably never induces fever except by causing congestion in some organ. I am inclined to regard the fever in the *Undaunted* as a climatic fever in the sense here defined. But I am not prepared to subscribe to the view that the bulk of the fever cases met with in the spring and autumn at Aden amongst the resident population are of this nature. The fact that the continued fever observed at Aden is specially prevalent at definite seasons—May and June, and again in October, and that, as we shall presently see, fever prevails at the same time in Muscat, and further, that these are the periods when malarial fever attains its first maximum in many parts of the northern hemisphere—appears to me to point to its miasmatic character.[1]

The town of Shaikh-Othman on the adjoining mainland, as well as the whole of this part of the peninsula, is excessively malarious. The remittent or continued fevers contracted at the former place are of a severe and often dangerous type, as the experience of the Medical Mission established there has sadly attested. We conclude, therefore, that if Aden itself is free, or almost free, from malaria, malarious foci of great intensity are to be met with in its immediate neighbourhood, and that the whole of the coast country near Aden is unhealthy,—a point which it may be well to bear in mind in the event of military expeditions being required in this region.[2]

MUSCAT.

Mr. Peters, the Civil Surgeon at Muscat, has given us some interesting details relating to the topography, climate, and diseases of this part of Arabia, which I shall condense. The country here

[1] Steinhauser notices the prevalence at Aden of the ulcer known as the "Yemen sore," which he defines to be a sloughing ulcer, showing a strong tendency to mortification. In 1853–54 above 3 per cent. of the persons admitted with ulcers died.

[2] Steven's "Report on the Country round Aden," *Journal Roy. Geog. Soc.* 1873.

is intersected by numerous water-courses forming some very fertile valleys lying between the various mountain chains. In one of these Muscat is situated. Just outside the fort is a large circular ditch about sixty feet in diameter. It is a salt marsh, in parts dry, in parts boggy, and covered with an incrustation of salt—except during the rainy months, when it is covered by the rain water from the surrounding hills. The huts of the poor people encroach upon the borders of this marshy ditch. The mixture of salt and fresh water, along with excreta and the putrid flesh of quadrupeds and fish, gives rise to a pestiferous atmosphere, and deaths from a severe form of remittent fever are frequent among the inhabitants and the poor pilgrims who crowd together in its vicinity. To the west of this lies another valley, called Meâbin, where a deep but dry wady runs along the foot of the hills, part of its damp bed being enclosed as a garden for growing vegetables. Further to the west, across a mountain, is the valley of Tuiân, noted for its sweet water wells, which supply Muscat with its drinking water. Both of these valleys are very populous.

Ague is endemic along the sea-coast and in the valleys. The spleen and liver become enlarged. Remittent fever, complicated with jaundice, prevails only at certain seasons when there is abundant malaria in the air. This is noticed chiefly when the north-westerly gales set in, the disease abating with a change in the direction of the wind. A shower of rain is observed to act beneficially rather than otherwise on the prevalence of malarial fever. Peters notices also the existence of a continued fever, probably similar to that observed by Palgrave on the table-land of Arabia, attended with severe headache and thirst, aggravated by quinine, but yielding to purgatives and emetics. The following table gives the monthly distribution of 1273 cases of malarious fever observed by Peters in 1873, 1874, and parts of 1872 and 1875, with the mean temperature, and the rainfall for 1873:—

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Mean temperature,	68·02	71·33	74·76	81·73	89·32	92·64	92·57	89·47	86·15	85·64	77·83	72·28
Rainfall of 1873, .	3·25	4·13	0·36	0·00	0·00	0·00	0·00	0·50	0·00	0·00	0·47	1·06
Percentage of Fever Cases, . .	5·8	5·2	9·1	9·9	10·3	8·2	4·3	6·6	9·1	10·7	9·9	10·3

Here we observe two maxima, one in March, April, and May, the other in September, October, November, and December, corresponding generally with those observed at Aden. The most feverish months are May and October, the least feverish are February and July.

CHAPTER VIII.

PERSIA, BALUCHISTAN, AFGHANISTAN.

GEOGRAPHY.—PERSIA.—The Elburz range of mountains runs along the southern coast of the Caspian Sea, forming the watershed in this direction. The strip of land between this range and the Caspian varies from five to thirty miles in breadth. On the west it opens out into the plains watered by the Kur and the Araxes—the plain of Mogan; on the east, again, it merges into the plains of the Gurgan and Atrek. The Elburz range thus shuts off the central plateau of Persia from the Caspian.

On the west the watershed between Persia and the Tigris valley is a more or less continuous double chain, running from the north-west to the south-east, parallel with the shores of the Persian Gulf, at the southern extremity of which it changes its direction to the east, running parallel with the Gulf of Oman. Elevated plains occupy the space between the ranges of this double chain. These ranges shut off the central plateau of Iran on the west and south.

The Turcoman, Afghan, and Baluchistan ranges form the watershed on the east. The great central plateau, thus almost closed in on all sides by high mountain ranges, is traversed by two parallel chains running from north-west to south-east.

The rivers may be divided into three systems—1st, the Oceanic—running into the Caspian, the Persian Gulf, or into the Arabian Sea; 2nd, those running into the great lakes; 3rd, the inland river system—the rivers belonging to which lose themselves in the sands or salt marshes. Of the 610,000 square miles included in Persia proper, 230,000 are estimated to drain into the seas, 60,000 into lakes, and 32,000 into the interior. This is an important fact in relation to the pathology of this region. The Elburz chain on the Caspian shore intercepts the moisture from the north, rendering the Caspian coast-line excessively humid, and at the same time rendering the central plateau dry. The southern chain along the Arabian Sea in the same way abstracts the greater part of the moisture coming

from the south, the result being that the great central plateau has a very scanty rainfall. Over a great part of Central and South-Eastern Persia and Baluchistan the annual rainfall is estimated at about five inches. A little rain falls in November. In December, and again in February, there are usually considerable falls of snow, followed by showers in March and April. From May to November little or no rain falls. The rainfall along the Caspian is heavy, that along the Persian Gulf is scanty.

The only plain near the sea-level is Khuzistan at the upper part of the Persian Gulf, through which flow the Diz, the Karun, and the Jerrahi. The flat lands along the shores of the Caspian and the Persian Gulf are generally narrow. The plains of Ispahan and Shiraz are about 5000 feet above the sea-level, that of Karman somewhat higher. The principal lakes are the Urmia, the Bakhtegan, and the Shiraz.

One remarkable feature of the Persian table-land, which has to be noticed, is the salt marsh called *kavir*. A kavir is an impassable bog covered with a saline incrustation that prevents evaporation, formed by a river or a mountain torrent at a place where there is not sufficient slope to allow it to run off.

The principal kavir is the great salt desert. It has no great elevation. It receives the Shurab Karsio from the west, and some streams from the east. Among the innumerable smaller salt marshes may be mentioned that on the Saidabad plain west of Karman, that in the valley of Kutru, that on the banks of the Zaindarud in the valley of the Kuh-Banán. Ordinary marshes are met with in numerous places, but, excepting those on the coasts and the marshes along the Seistan Lake on the frontier of Afghanistan, they are not of any great extent.

In a great part of Persia cultivation can only be carried on by irrigation, by means of streams, canals, or wells, or of the underground channels called *kanát*. It will readily be understood, then, that the population in the plateau is gathered into centres where water is to be had, sufficient not only for domestic purposes, but for irrigation. The dry, barren, sandy, rainless desert tracts, as well as the districts covered by salt marshes, are uninhabited. Hirsch refers to the existence of malaria on the table-land of Iran, "which lies always under a cloudless sky and bright sun, and has no water from natural sources," as one of the remarkable instances of malaria occurring in dry places. Such, no doubt, it is. Yet we should not forget that the driest districts often become the most humid and water-logged under the influence of irrigation, and that it is just such localities that are the centres of population. As the

dry sandy deserts are uninhabited, we have no means of ascertaining whether or not they are malarious.

CLIMATOLOGY.—As we have already noticed the distribution of rainfall in various regions of Persia, it will suffice to add a few particulars respecting the climate of Teheran. Teheran, the capital, is situated at an altitude of 3840 feet above the sea-level. During four months of the year the heat is intolerable, the thermometer standing at 86° to 94° F. in the shade. In winter the thermometer has been seen to fall to 20° below freezing point. The coldest month is January, the hottest July. The highest temperature in the centre of the town, where the natives live, is about 110° F. In the European quarter it does not exceed 102° F. The great characteristic of the climate is the extreme dryness of the atmosphere, especially in summer. The annual rainfall was formerly only ten or twelve inches at Teheran; of late years it has been somewhat heavier. This may be taken generally as a type of the climate in the central parts of Persia.

PATHOLOGY.—*Malaria.*—The western and southern shores of the Caspian, from the Araxes, through the marshy provinces of Ghilan and Mazanderan, are highly malarious. Resht and its neighbourhood is particularly feverish.[1] The plain of Mogan on the west, and the plains of the Atrek and the Hürgen on the Turcoman frontier, are alike noted for the amount and intensity of the endemic fever by which they are infested. Stebnitzky informs us that the Turcomans of the Atrek and Hürgen, in order to escape the fever, are often compelled to migrate in summer to the steppe.[2] The fever met with in these provinces, and which is most prevalent from August to October, frequently assumes the remittent type, and is often complicated with enlargement of the liver and spleen, and with lymphyngitis. Although our information respecting the high lands of Kurdistan and the Zagros mountains is very scanty, they are known to be comparatively, if not entirely, exempt from the disease. The plains of Khuzistan share with the delta of the Euphrates, already described, the claim to be reckoned amongst the most malarious regions of the world. Mohammara, the chief port of the Karun River, is described as a regular plague-spot. The surveyors of the Turco-Persian Boundary Commission suffered greatly in this locality, as did also the English expedition in 1857. Two of the officers belonging to this expedition committed suicide, and one died of fever. The eastern shores of the Persian Gulf are almost throughout visited by malaria, as are also the coasts bordering on

[1] Bonvalot, *Through the Heart of Asia*, London 1888.

[2] *Journal Roy. Geog. Soc.* 1874.

the Gulf of Oman. Bander Abbas, or the Gombroon, was found by Ives in the last century almost deserted—the inhabitants suffering from 'putrid intermittent fevers,' which raged from May to September, and up to the present day the inhabitants, who can afford to do so, leave the place during the summer and autumn months, and take refuge either in the shady gardens at the top of Ganao, or go to Minãb. Pernicious attacks, succeeding to the tertians, are common from August to October. Coming to the central plateau, we find that malaria, although in a less intense form, prevails even here to a considerable extent. The province of Azerbijan, at a height of about 4000 feet, is generally salubrious.[1] Malarial fevers and their sequelæ are, on the other hand, very common at Teheran.[2] This city, which is situated on a dry plain, is to a large extent supplied with water from subterranean streams. The country, especially towards the north, is extensively irrigated. "It is supposed that a marshy tract of country close to Teheran has to answer for much of the fever met with here." These fevers prevail in the months of November, December, and January, when the cold is very intense. Malarious diseases are also met with at Kum, Kashan, Ispahan, and Yezd. Shiraz, in Cœle-Persia, situated in a hollow formed by two parallel chains of mountains, with a moist subsoil, is, notwithstanding its elevation, to a marked degree malarious.

Karman, at an elevation of 5700 feet, in the centre of an irrigated area, where the summer heats are intense and sudden vicissitudes common, is not spared. Of Bampur, in the east, the Boundary Commissioners, from whose report I have gathered a number of the details given in this chapter, state that "the highly irrigated land to the south and the burning desert to the north cause sudden changes of temperature and alterations from intense dryness to complete saturation, which make Bampur a by-word for unhealthiness." Malaria, in a less severe form, prevails along the Afghan border around the Zirreh Swamp and the Seistan Lake.

Bell's account of the disease called Tab-i-ghash, or fainting fever, as seen at Teheran and the surrounding country, is so often referred to and so little known, that it may be well to reproduce it here. "Its usual form is an ague in which—1st, the cold fit is accompanied by extreme oppression at the heart and pain when pressure is made on the pit of the stomach. This goes on for some days. When at the commencement of each ague fit the patient becomes insensible, the pulse is not to be felt; he neither shivers nor

[1] Eastwick's *Three Years' Residence in Persia*, London 1864.

[2] Private letter, dated 24th February 1890, from a medical man who has practised for nine years in Teheran.

sweats properly, and his skin is cold and clammy; if you bleed him, no blood comes; he has a few spasms, and dies mottled, like a man in cholera. 2nd, Sometimes there is pain and hardness of the belly and no ague; this the Persians fancy to be colic, but it is the same complaint; the pulse gets weaker, the skin colder, oppression at the heart greater, and the patient dies as in cholera. 3rd, Sometimes, with scarce any previous symptoms, the skin is puffed up in an hour or two, and the man nearly suffocated with oppression of the chest and dropsy. This is a sort of inward sweating, where the perspiration does not come out. I hear this is very prevalent at Burajird. This requires bleeding freely, and calomel and jalap-tartar in strong doses. 4th, But the commonest form is a daily ague, with pain and swelling under the ribs of the left side, viz. in the spleen. 5th, More rarely, there is the regular purging and vomiting of the blue cholera, with strangury, but spasms only come on before death. 6th, Often after eating water-melon people are found dying or dead in their beds without previous complaint; in children and infants it is very prevalent; without shivering they become cold and insensible, only recovering during the fever to fall again into a state of insensibility, and dying in the same manner after two or three such alternations. Now this is all the same complaint, and is to be treated in the same way."

Typhoid Fever, according to the information I have received from Teheran, is of frequent occurrence there. Cases that are called typho-malarial are also met with. The extent to which the disease occurs in the different provinces is unknown.

Typhus may be regarded as endemic in Persia. It is met with, although apparently not frequently, at the capital, and to a greater or lesser extent at numerous points in Persia. Polak observed an epidemy of the disease in 1857, which was chiefly confined to the troops. It was also epidemic in the years 1864–66, and I have received accounts of a severe outbreak in the town of Kasvin in the summer of 1879.

It is uncertain whether *Relapsing Fever* exists in Persia.

Diphtheria (1890) is common in Teheran, but appears to have been rare before 1858. I have no accounts of *Croup* from Teheran.

Plague. — Twelve epidemies of the plague are known to have occurred from 1571 to 1863. From 1864 up to 1885 numerous local outbreaks have been witnessed in different localities along the western frontier. In 1876–78 a severe epidemy occurred at Resht, in the province of Ghilan. In 1885 it broke out at Hamadan. Azerbijan has been the province which has suffered most during recent years. The plague has generally been introduced

into Persia from Mesopotamia, and has been chiefly confined to the provinces of Azerbijan and Kurdistan. Teheran and Ispahan have hitherto escaped.

Cerebro-spinal Meningitis was observed in Persia in 1874–75.

Dysentery and *Diarrhœa* prevail in summer, and *Cholera nostras* makes many victims in the beginning of autumn.

Epidemic Cholera made its first inroad into Persia in the year 1821. Appearing at Bander Abbas, it penetrated into the north-eastern part of the interior by the Yezd caravan route. The north-western part of the country was infected by the troops from Bagdad, where, as well as at Bushire, the disease was then raging. In the following year the provinces of Ghilan and Mazenderan were attacked, but Teheran escaped until the second visitation of the disease in 1829. Subsequent outbreaks, some of which have been very destructive and others very persistent, have occurred in the years 1844–46, 1853, 1856, 1857, 1859–61, and irregularly at various points and intervals from 1865–72. (Hirsch.)

Measles and *Scarlet Fever* are common diseases in Teheran. The same is the case as regards *Smallpox*, which however, at the present time, is expressly said to be milder than in Europe.

Pneumonia and *Bronchitis* are very prevalent in Teheran in winter and spring.

Phthisis, according to all authorities, is decidedly rare in Persia, and is even said to be unknown in the mountainous regions. This does not, however, apply to the capital, where my correspondent says that he has seen many well marked cases of the disease during his nine years' residence.

Leprosy, according to Hirsch, is confined, as in endemic, to a few districts of the hill country of Irak Ajemi, and in the provinces of Azerbijan and Khuzistan; but does not occur at all on the shores of the Caspian. This distribution is not apparently in favour of the theory that leprosy is caused by a fish diet.

Scrofula is rare among the Persians.

Cancer is seldom met with.

The *Aleppo Boil* is a common disease of childhood in the interior, but is unknown along the shores of the Caspian.

Syphilis, contrary to what is generally stated, is very common in the capital.

Acute Rheumatism does not appear to be common.

Rickets are said to be almost unknown.

BALUCHISTAN.

Malaria is endemic along the Mekran coast. At Gwadur, in 1873, fifty of the men of the *Rifleman*, who landed during the latter part of July and the beginning of August, contracted remittent fever. It is stated that heavy rains had fallen at the time after a prolonged drought. The disease is described by Surgeon Hill (*Navy Report*, 1873) as beginning suddenly, generally without rigor, with great prostration, constrictive pain of forehead, heat of skin, nausea or vomiting, pains all over the body,—especially in the back, loins, and præcordial region,—thirst, loss of appetite, constipation, tongue coated in centre, clean at edges; urine scanty, high coloured, not albuminous; with giddiness, ending sometimes in delirium. There were morning remissions, and evening exacerbations in a more serious form, unless checked by treatment. The period of remission was sometimes that of the greatest danger in consequence of the sinking of the vital forces, coldness of the extremities, and profuse perspiration. The intermittent type occurred later in those who had suffered from this remittent form. It will be observed that this fever differs widely from that which occurred on the *Undaunted* at Aden.

As respects other diseases, the pathology of Baluchistan differs little from that of Afghanistan, which we shall presently consider.

AFGHANISTAN.

GEOGRAPHY.—Afghanistan is separated from Bokhara on the north by the Amu-Daria or Oxus from its source in the Sir-i-Kul Lake to Khoja Saleh. To the west of this point the new boundary line crosses the Turkoman desert south of Panjdeh to strike the Hari-Rud near to Zulfikar. On the south it is bounded by Baluchistan; on the east by the Suliman range of mountains, by which it is separated from India; and on the west it is divided from Persia by the Hari-Rud on the north, and by a line extending from this river to the Seistan Lake. The area of the country is estimated at 240,000 square miles, with a population of about 5,000,000.

CLIMATOLOGY.—The climate of Afghanistan is extreme, especially in the mountainous regions of the east and north-east. At Ghazni (7279 feet), and even at Kabul (5600 feet), the winters are extremely cold. At Herat and along the west frontier generally the climate is milder. At Quetta, situated in the south-east, close on the borders of Baluchistan and India, the mean temperature, and daily range (1883), and the average rainfall for six years was as follows:—

	Mean Temperature.	Daily Range.	Rainfall Average.
January,	37·6	17·5	0·94
February,	39·8	22·4	1·67
March,	48·4	22·5	1·90
April,	59·9	25·3	0·94
May,	67·2	29·1	0·31
June,	76·1	32·3	0·17
July,	76·3	25·9	1·00
August,	75·0	32·3	0·57
September,	68·4	35·4	0·21
October,	54·8	34·9	0·00
November,	43·9	29·9	0·00
December,	40·9	26·2	0·53
Means and Total,	57·8	27·8	8·24

PATHOLOGY.—*Malaria.*—Malarial fevers, both remittent and intermittent, but especially the latter, have been among the most prevalent diseases affecting the Indian troops during the various Afghan campaigns. No part of the country, so far as we know, is exempt from fever. During the last war malarial fevers formed one of the principal causes of sickness among the troops stationed in Kabul, Jellalabad, and Kandahar. Perhaps the high lands stretching between Jellalabad and Kabul are as free from fever as any part of the country. The passes between India and Afghanistan—the Khyber, the Kuram, and the Bolam passes, in their lower and narrower defiles—are notably malarious;[1] the higher elevations, especially when open, are comparatively salubrious. Malaria prevails along the Persian frontier in the neighbourhood of the Seistan swamps.

Typhoid Fever is a widely diffused disease in Afghanistan. Crawford (*Army Medical Report,* 1880) states that "at all the posts occupied by the European troops co-operating with the various columns in Afghanistan, extending from the British territory up to Kabul and Kandahar, cases of enteric fever appeared, some of which posts and camps must in all human probability have been occupied for the first time in the late campaign." We shall revert to this important observation in connection with the etiology of typhoid fever in India.

It is probable that *Bilious Typhoid* is also epidemic in the country from time to time.

Cholera is not endemic in Afghanistan, but it has on several occasions invaded the country from India, notably in 1827, 1842, 1859–61, and 1879–80.

Dysentery has proved to be one of the most fatal diseases among

[1] Crawford says: "As regards fever, some of the places in the Khyber were disproportionately malarious and unhealthy; as, for instance, Lundi Kotal, Ali Musjid, Dakka, and Jellalabad, but especially the former" (*Army Medical Report,* 1880).

the troops in Afghanistan, and it doubtless prevails to a considerable extent among the natives, although we have no reason to suppose that it is severely endemic in the country generally. Dysentery and diarrhœa have made numerous victims among the troops stationed at Quetta. Lundi Kotal (3500 feet) is noted for the prevalence of dysentery.

Phthisis is not unknown in Afghanistan, but I have no data for estimating its prevalence.

Pneumonia and *Pleurisy* are common affections throughout Afghanistan. The British troops suffered considerably from respiratory diseases in winter.

Hepatitis, although not widely prevalent, is met with in the more malarious localities.

I have not met with any accounts of the existence of *Leprosy* in Afghanistan; nor am I able to state to what extent *Goitre*, *Syphilis*, and *Scrofula* prevail.

Rheumatism is one of the most common affections among the natives.

ASIA.

DIVISION II.

INDIA, CEYLON, BURMA.

CHAPTER I.

INDIA.—GEOGRAPHY AND CLIMATOLOGY.

GEOGRAPHY.—The great natural divisions of India are—1st, The sub-Himalayan region. 2nd, The Punjab, or plains of the Upper Indus. 3rd, The plains of the Upper Ganges. 4th, The table-lands of Malwa, Meywar, and Rajputana. 5th, The Lower Indus and its delta. 6th, Lower Bengal and the delta of the Ganges. 7th, The Peninsula proper south of the Vindhyan Mountains. These natural divisions correspond more or less to the political divisions, which we shall have to follow in this work, as the statistics apply only to the political divisions.

1. The sub-Himalayan region includes Cashmere, Gurhwal, Kumaon, Nepal, Sikkim, and Bohtan. A shallow depression, 5 to 30 miles in width, extending along the base of the Himalayas from Hurdwar to the Brahmaputra, is known as the Terai. The want of fall prevents the rainfall and the water from the hills from being rapidly carried off. The accumulation of moisture in this shallow trough is further favoured by the clayey nature of the subsoil, which hinders percolation. The Terai is thus a swampy region, covered with forest, jungle, or grass, the haunt of wild beasts. The sub-Himalayan region has a heavy rainfall; the temperature at the higher elevations is temperate.

2. The plains of the Punjab, or Upper Indus, stretch from the frontier mountains of Afghanistan, on the west, to the Jumna. The northern districts are divided into numerous valleys by offshoots from the Himalayas, but the south forms a comparatively level expanse, sloping gently towards the plains of Sind, where it narrows to a point, and is unbroken by any elevations, except the Salt Range between the Indus and the Jhelum, from 2000 to 5000 feet high. It is watered by the Indus and its five affluents, viz. the Jhelum, the Chenab, the Ravi, the Beas, and the Sutlej. These rivers divide the country into four interfluvial plains or *doabs*:—the Sind Sagar Doab; the Jetch Doab; the Reechna, or Richna, Doab; and the Bari Doab.

The principal canals are the Bari Doab, the West Jumna, the Sirhind, the Sutlej (upper and lower), the Muzaffargarh, and the Swat. The districts where irrigation is most extended are those around Amritsar, Lahore, Mooltan, Muzaffargarh, Lodhran, and Mailsi, the country to the east of Montgomery, and the district of Dera Ghazi Khan. The soil varies from a sand to a stiff clay. The country is bare, and cultivation in many parts is chiefly carried on by means of irrigation.

The Punjab has two seasons of rainfall—the monsoon, from the middle of June to the end of September, which brings the greater part of the annual supply, upon which the autumn crops and spring sowings depend, and the winter rains, which fall early in January, and which, though insignificant in amount, affect very materially the prospects of the spring harvest. The Rabi, or spring crop, is the most important, the Kharif, or autumn crop, less so. The average annual rainfall of the Punjab is about 21 inches.

3. The plains of the Upper Ganges, comprising the North-West Provinces and Oudh, extend from the Jumna on the west to the western boundary of Patna on the east, and from Gurhwal on the north to the Central Provinces on the south. This country, which comprises the Doab, Rohilkund, Oudh, and Benares, has a gradual slope from the north-west to the south-east. This extensive region is watered by the Ganges and its tributaries, including the Jumna, Goomtee, and Gogra, and is irrigated by the Ganges Canal and its numerous branches.

4. The table-lands of Malwa, Meywar, and Rajputana have elevations of from 800 to 2000 feet above the sea-level. Excluding the fertile portions along the Loni River, the greater part of Rajputana is a sandy tract, destitute of streams, with a scanty rainfall. Water is only found at great depths. The extensive plains of the Meywar plateau are fertile, when irrigated, and almost every village has its artificial lake.

The States of Bikanir and Jaisalmir depend entirely upon the scanty supply of rain which sinks into the soil and does not run off, so that a very light rainfall suffices for the crops. (Hunter.)

The Malwa table-land is better watered and more fertile.

5. The Lower Indus and its delta. The delta, which extends for 125 miles along the coast, is perfectly level and destitute of trees. The soil generally consists of sand, clay, and vegetable mould, and is fertile where irrigation is possible. In some places it is marshy. Higher up, in the province of Hyderabad, Thar and Parkar, Shikarpur, and Upper Sinde frontier, the soil is in some parts sandy, in others clayey. Shikarpur has a rich alluvial clay,


INDIAN EMPIRE
Scale of English Miles.
0 50 100 200 300 400
Railways thus
TURKESTAN
TIBET
AFGHANISTAN
BALUCHISTAN
PUNJAB
RAJPOOTANA
CENTRAL PROV.
LOWER PROV.
UPPER BURMA
BHOTAN
CHINA
ARABIAN
BAY
Kuen Lun Mts.
Hindoo Koosh
Cashmere
Khotan
Yarkand
Balkh
Kunduz
Cabool
Ghuznee
Jelalabad
Peshawur
Lahore
Kelat
Sibi
Srinagar
Iskardo
Leh
Gartok
Manasarowar L.
Shangai
Chargut Cho
Tengri Nor
LASSA
Sangpo
Nap Chu R.
Ya-lung R.
Kin-sha R.
Lan-tsang R.
Gyala Sindong
Bhawulpoor
The Thar or Indian Desert
Jodhpoor
Allahabad
Benares
Lucknow
Patna
Moorshedabad
CALCUTTA
Dacca
Chittagong
Akyab
Jellasore
Balasore
Cuttack
Pt. Palmyras
Mahanuddy R.
Mandalay
Katchin
Momein
Tropic of Cancer
Gulf of Cutch
Poorbunder
BOMBAY
Bassein
Salsette I.
Daman
Surat
Baroda
Mths. of the Indus
Hydrabad
Kurachee
Omercote
Ahmedabad
Nagpore
Ramgarh
Sumbulpoor
Mts. Everest 29002
Darjeeling
Khatmandoo
Tassisudon
Lat.
35
30
25
20
70
75
80
85
90
95
100

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which only requires rain to render it fertile. Along the banks of the Indus the soil is a rich alluvium, irrigated and fertile, but in many parts it contains much salt and nitre. The irrigated area in Karachi extended in 1883–84 to 248,371 acres, in Haiderabad to 517,403 acres, in Shikarpur to 563,897 acres, in Upper Sind frontier to 209,867 acres, and in Thar and Parkar to 88,362 acres. The Indus begins to rise in March, attains its maximum in August, and subsides in September. At Haiderabad the rise is about 15 feet, and often causes extensive flooding. The climate of the Lower Indus valley is extremely hot in the summer months, and although it has only a very scanty rainfall the air is often very moist. Fogs occur in the mornings and evenings, with night dews in September and October. The extensive irrigation, the frequent inundations, and the humidity of the air, are facts which are believed to have special importance in regard to the pathology of this region.

6. Lower Bengal and the delta of the Ganges. This region may be described as a vast alluvial and nearly level plain, watered by the Ganges and the Brahmapootra and their numerous affluents, forming a complete network of streams, which tend to change their channels from time to time. The country is naturally jungly and swampy, and in some places, such as the Sunderbunds, the jungle is impervious—the haunt of tigers, jackals, and leopards. It is subject in many parts to inundations. This province is densely peopled, and as a whole well cultivated. The rice crops, which form the principal culture, necessitate the putting of large tracts annually under water. The delta may be said to extend about 200 miles along the coast, and inland for 180 miles. By the end of July large portions of this region are covered with water—villages on slight elevations forming islands, as it were, in a great lake.

7. The peninsula proper extends from the Vindhyan chain south to Cape Comorin. It consists, 1st, of an elevated table-land, 1500 to 3000 feet above the sea, bounded on the north-west by the Vindhyan range, and on the north-east by the high lands forming the southern watershed of the Ganges; on the east and west it is bounded by the Eastern and Western Ghauts, which run along both sides of the peninsula, shutting the table-land off from the sea; 2nd, of a littoral region extending between the sea and the Ghauts. The low country between the sea and the Western Ghauts varies from 5 to 50 miles in breadth; on the eastern side the plains are from 25 to 100 miles in width.

The northern parts of the table-land comprise what are termed the Central Provinces; the districts of Saugor and Damoah in the north drain into the Ganges valley. To the south, in the valley of

the Nerbudda, are Mandla, Jubbulpore, Narsinghpur, Hoshangabad, and part of Nimar. Still farther south we have Betul, Chhindwara, Seoni on the high lands of the Satpura table-land, and Balaghat. These districts attain a height of 2000 feet. To the south, again, is the great Nagpur plain, comprising the districts of Nagpur, Wardha, Bhandara, and Chanda. This region has a considerable elevation. The general surface slopes towards the south-east coast of Orissa and the Northern Circars. The central and eastern parts of this region are drained by the Mahanuddy and Godavery rivers, which fall into the Bay of Bengal. On the north and west the streams join the Nerbudda, which empties itself into the Gulf of Cambay, and the Tapti, which also runs to the western coast, to fall into the sea at Surat.

The north-eastern part of the Central Provinces is to a considerable extent covered with jungle, and in many places it is marshy. The town of Nagpur is situated in a hollow, at an elevation of about 1000 feet above the sea-level. The soil of this part is the black cotton soil. The temperature throughout this region is high in summer, and comparatively low in winter. The annual range is high, and so is the daily range. At Kamptee, for example, in June 1878, the thermometer reached 120° in the shade; while in December of the same year it fell to 25°. The average rainfall varies much in different districts. The average at Kamptee is about 22 inches; in 1887 it reached 52 inches.

The Deccan proper, or the Nizam's Dominions, is a part of the same plateau, but situated to the south of the Central Provinces. Excluding the province of Berar, it covers an area of 71,771 square miles. It is from 1500 to 2000 feet above the sea-level. Annesley thus describes the country: "It is hilly but not mountainous. The hills are chiefly composed of granite, which has the appearance of having been dislocated by some powerful force. The masses are of all sizes, and almost always quite bare and weather-worn, thrown into the most fantastic and irregular forms. The face of the country is rough, rocky, and sterile, consisting of a succession of heights and hollows; . . . the hollows or valleys are generally formed into lakes or tanks, by blocking them across with strong mounds (bunds) of stone or earth, for the purpose of irrigating the land."[1] Secunderabad, the chief military station, is situated at a height of 1800 feet above the sea. The rainfall in 1860 was 18·50 inches; in 1876 it was a little over 15 inches; in 1877, 30·90 inches; in 1878 it was 46·15 inches. The province is drained by the Godavery and Kistna. Its cultivated, and consequently more densely-inhabited districts, are studded with enormous tanks, some of which attain the

[1] Annesley, *Diseases of India*, Lond. 1841, p. 116.

proportions of lakes, being many miles in circumference, by means of which rice cultivation is carried on. Annesley notices that fogs collect, morning and evening, along the whole tract of the low, swampy rice districts.

To the south of the Deccan is Mysore, with an average elevation of 2000 feet, reaching in some places to 4000 or 5000 feet, and sloping towards the north and north-east. In the northern part of the country the rivers run northwards to join the branches of the Kistna. The Cauvery, rising in the high lands in the south, runs south-east; while the Pennar drains the lower eastern slopes.

Bangalore, the most important military station, is 3000 feet above the sea. The soil of Mysore is in many places formed of decomposed gneiss, the rock disintegrating readily under exposure to the air. In the valleys the soil is generally a dark fertile loam. The average temperature of Bangalore is 72°·9, rising to 85° or 90° in the hot season, and falling to 60° in cool nights. The rainfall averages 35·87 inches per annum; but, like at most of the stations in the Deccan, it varies much from year to year.

Vital Statistics.—The following table gives the civil divisions of India, the area of each, the number of towns and villages, the population, the number of persons per square mile, and the number of towns and villages per 100 square miles:—

Province or State.	Area in Square Miles.	No. of Towns and Villages.	Population.			No. of Persons per square mile.	No. of Towns and Villages per 100 Miles.
			Males.	Females.	Total.		
Ajmere,	2,711	739	248,844	211,878	460,722	170	27
Assam,	46,341	22,408	2,503,703	2,377,723	4,881,426	105	48
Bengal,	193,198	264,765	34,625,591	34,911,270	69,536,861	360	137
Berar,	17,711	5,585	1,380,492	1,292,181	2,672,673	151	32
Bombay:—							
British territory,	124,122	24,598	8,497,718	7,956,696	16,454,414	133	20
Feudatory States,	73,753	13,191	3,572,355	3,368,894	6,941,249	94	18
Burma,	87,720	15,857	1,991,005	1,745,766	3,736,771	43	18
Central Provinces:—							
British territory,	84,455	34,612	4,959,435	4,819,356	9,838,791	117	41
Feudatory States,	28,834	11,242	867,687	842,033	1,709,720	59	39
Coorg,	1,583	503	100,439	77,863	178,302	113	32
Madras,	141,001	52,648	15,421,043	15,749,588	31,170,631	221	37
N.-W. Provinces:—							
British territory,	106,111	105,421	22,912,556	21,195,313	44,107,869	416	99
Feudatory States,	5,125	3,322	384,699	357,051	741,750	145	65
Punjab:—							
British territory,	106,632	34,324	10,210,053	8,640,384	18,850,437	177	32
Feudatory States,	35,817	18,546	2,112,303	1,749,380	3,861,683	108	52
Baroda,	8,570	3,012	1,139,512	1,045,493	2,185,005	255	35
Central India,	75,079	31,506	4,882,823	4,379,084	9,261,907	123	42
Cochin,	1,361	655	301,815	298,463	600,278	441	48
Hyderabad,	71,771	20,398	5,002,137	4,843,475	9,845,594	137	28
Mysore,	24,723	17,655	2,085,842	2,100,346	4,186,188	169	71
Rajputana,	129,750	30,001	5,544,665	4,723,727	10,268,392	79	23
Travancore,	6,730	3,719	1,197,134	1,204,024	2,401,158	257	55
Total,	1,372,588	714,707	129,941,851	123,949,970	253,891,821	185	52

The registration system of India is still in its infancy, and is far from perfect. The returns for Bengal, Assam, Madras, Coorg, and

the Feudatory States are specially defective and unreliable, and for most purposes useless; those for the Punjab, the North-West Provinces, the Central Provinces, the Hyderabad Assigned Districts, and Bombay and Bengal, although not accurate, are more trustworthy, and, judiciously used, enable us to draw important inferences as to the health of the population in these parts of the empire.

We shall here give in a tabular form the birth and death rates of the principal provinces. Those for Bengal and Madras are estimated from official returns; for the other provinces the figures are from the Administration Reports for recent years, and are all somewhat below the true ratios, the defects being greater in the birth than in the death rates:—

Bengal.		North-West Provinces.		Punjab.		Bombay.	
Birth-rate (estimated).	Death-rate (estimated).	Birth-rate 1882–86.	Death-rate 1882–86.	Birth-rate 1881–85.	Death-rate 1882–86.	Birth-rate 1882–86.	Death-rate 1874–85.
5·0	32·0	40·2	32·3	38·8	28·0	32·6	26·16

Central Provinces.		Hyderabad Assigned Districts.		Madras.	
Birth-rate 1881–87.	Death-rate 1881–87.	Birth-rate 1883–87.	Death-rate 1883–87.	Birth-rate (estimated).	Death-rate (estimated
41·2	31·3	40·5	38·4	30·0	25·0[1]

More dependence may be placed on the accuracy of the death-rates for the three Presidency cities than of those of the Provinces; but the birth-rates, even of these, are not reliable. The population of Calcutta is abnormal in respect to the proportion of the sexes, the males being nearly two to one female. A similar, although less marked, disproportion obtains in Bombay.

Calcutta.		Madras.		Bombay.	
Birth-rate (estimated).	Death-rate 1881–84.	Birth-rate 1880–84.	Death-rate 1880–84.	Birth-rate 1881–84.	Death-rate 1881–84.
24·0	29·4	40·9	41·1	19·3	29·9

The death-rates of children under one year of age are everywhere excessively high. In 1884 the deaths of children under one year formed 28·36 per cent. of the total deaths at all ages in the city of Bombay; 21 per cent. in Calcutta; and 22 per cent. in the Madras Presidency. The proportions are still higher in the Punjab, the North-West Provinces, and the Central Provinces, where they vary from 28 to 31 per cent. But all these proportions are probably under the truth.

The seasonal mortality varies considerably in the different provinces, and in the individual districts in each province. The months of greatest mortality are, for Assam, May, June, and July; for Bombay, July, August, and September; for the Central Provinces and Assigned Districts, August, September, and October; for the

[1] The death-rate of this Presidency for the six years 1884–89 is given at 21·5 per 1000. This is certainly much below the true figure.

North-West Provinces, September, October, and November; for Bengal, November, December, and January; and for Madras, December, January, and February.

CLIMATOLOGY.—India, extending over nearly 27° of latitude, and lying partly within and partly without the tropics, necessarily possesses a very varied climate. The diversities of altitude occasioned by great mountain ranges, as well as the physical configuration of the country, with its extensive low plains, and elevated plateaux, give rise to extensive varieties of temperature; the same circumstances determine great differences in the annual rainfall of particular regions. For our purpose it will be sufficient to give here a table of the mean temperature and rainfall of certain representative stations for future reference:—

AVERAGE AIR TEMPERATURE AND RAINFALL OF CERTAIN STATIONS IN INDIA.

	Punjab.						North-West Provinces.					
	Peshāwar (1110 feet).		Mooltan (420 feet).		Lahore (732 feet).		Meerut (737 feet).		Agra (555 feet).		Lucknow (369 feet).	
	Temp.	Rain-fall.	Temp.	Rain-fall.	Temp.	Rain-fall.	Temp.	Rain-fall	Temp.	Rain-fall.	Temp.	Rain-fall.
January, .	49·5	1·58	53·8	0·25	53·6	0·52	56·9	0·84	59·8	0·53	60·3	0·76
February, .	51·7	1·52	58·2	0·30	59·0	1·30	62·1	0·84	65·1	0·32	65·8	0·35
March, . .	63·2	1·50	70·7	0·46	69·6	0·99	73·4	0·63	76·9	0·22	76·4	0·25
April, . .	71·3	1·91	79·6	0·38	81·1	0·67	83·5	0·44	87·3	0·17	86·5	0·15
May, . .	80·2	0·72	88·8	0·45	88·5	0·78	88·3	0·78	93·2	0·71	91·7	0·79
June, . .	88·4	0·20	94·4	0·37	93·2	1·67	92·4	3·69	94·1	2·85	92·3	4·41
July, . .	89·0	1·75	92·0	2·08	89·0	6·87	86·4	9·47	87·1	9·13	86·4	10·85
August, . .	86·4	2·48	89·0	1·36	87·9	4·73	85·1	6·50	85·2	6·32	85·6	10·37
September, .	80·6	0·68	86·4	1·12	84·8	2·09	83·1	3·91	84·0	4·56	84·2	7·99
October, . .	70·7	0·26	76·7	0·13	77·0	0·63	74·6	0·46	79·5	0·36	78·6	1·55
November, .	58·0	0·94	66·5	0·08	64·9	0·17	66·0	0·05	70·2	0·03	68·5	0·02
December, .	50·1	0·75	56·0	0·31	55·2	0·58	58·1	0·37	61·8	0·26	60·7	0·42
Year, .	69·9	14·29	76·0	7·29	75·3	21·00	75·8	27·98	78·7	25·46	78·1	37·91

	Bengal.						Central Provinces.					
	Patna (183 feet).		Dacca (22 feet).		Calcutta.		Saugor (1769 feet).		Hoshangabad.		Nagpur (1025 feet).	
	Temp.	Rain-fall.	Temp.	Rain-fall.	Temp.	Rain-fall.	Temp.	Rain-fall.	Temp.	Rain-fall.	Temp.	Rain-fall.
January, .	61·0	0·73	66·5	0·31	64·7	0·02	63·3	0·62	66·0	0·36	68·6	0·64
February, .	65·9	0·59	71·7	1·02	69·9	1·22	67·8	0·59	70·5	0·17	73·7	0·46
March, . .	77·6	0·28	79·4	2·44	77·4	0·44	78·0	0·16	79·4	0·21	82·0	0·61
April, . .	86·6	0·30	82·9	5·96	82·0	1·92	85·2	0·20	87·9	0·04	88·6	0·49
May, . .	88·6	1·46	83·4	9·18	83·1	6·56	88·4	0·64	92·7	0·57	92·9	0·86
June, . .	88·6	6·55	83·8	13·11	82·3	7·66	85·5	6·12	88·2	5·34	86·5	8·61
July, . .	84·7	10·19	83·4	13·17	81·7	12·96	77·5	17·00	79·4	14·19	79·1	12·52
August, . .	84·1	9·50	83·6	12·46	81·6	13·36	76·4	11·33	78·4	13·04	79·1	8·84
September, .	83·9	8·29	83·6	10·42	81·6	9·74	77·2	7·95	79·4	10·00	79·1	7·57
October, .	79·6	2·80	81·6	5·53	78·8	2·61	75·5	1·19	77·3	0·79	74·1	2·14
November, .	70·3	0·22	75·2	0·72	72·0	0·31	70·2	0·38	70·8	0·40	70·9	0·29
December, .	62·3	0·13	68·4	0·20	65·1	0·86	64·1	0·31	66·7	0·29	67·4	0·37
Year, .	77·8	41·04	78·6	74·52	76·7	57·66	75·7	46·49	78·0	45·40	78·5	43·40

AVERAGE AIR TEMPERATURE AND RAINFALL OF CERTAIN STATIONS IN INDIA.

	RAJPUTANA.						BOMBAY.					
	Bikanir (744 feet.)		Ajmeer (1611 feet).		Indore (1823 feet).		Haiderabad (94 feet).		Karachi (49 feet).		Bombay.	
	Temp.	Rain-fall.	Temp.	Rain-fall.	Temp.	Rain-fall.	Temp.	Rain-fall.	Temp.	Rain-fall.	Temp.	Rain-fall.
January, .	60·1	0·01	58·9	0·15	64·6	0·40	62·8	0·16	64·9	0·62	72·7	0·12
February, .	63·7	0·35	64·8	0·37	68·5	0·34	66 3	0·17	67·8	0·25	74·2	0·02
March, . .	78·7	0·09	75·4	0·48	77·2	0·02	79·4	0·09	76·9	0·15	78·2	0·00
April, . .	88·1	0·35	85 3	0·09	83·3	0·17	86·0	0·07	80·8	0·01	81·7	0·04
May, . .	93·5	1 45	91·0	0·66	87·5	0·42	90·9	0·03	85·6	0·06	84·2	0·59
June, . .	94·7	3·30	90·6	2·57	84·4	6·20	90·8	0·49	86·7	0·20	82·7	20·89
July, . .	91·4	3·15	84·0	6·33	77·8	10·30	88·3	2·58	83·9	2·73	80·8	24·17
August, . .	86·5	4·84	81·6	7·85	76·5	8·93	85·8	3·34	82·0	1·97	79·7	15·15
September, .	88·7	1·20	82·6	3·36	76·9	9·04	86·5	0·63	82·2	0·90	79·5	10·81
October, . .	83·9	0·08	78·3	0·31	76·2	0·95	83·3	0·01	79·6	0·08	80·3	1·62
November, .	70·8	0 02	68·9	0·16	67·8	0·16	72·0	0·07	72·4	0·08	77·9	0·49
December, .	60·6	0·04	61·5	0·32	62·8	0·14	62·3	0·01	67·0	0·21	74·8	0·04
Year, .	80·1	14·88	76·9	22·65	75·3	37·07	79·5	7·65	77·5	7·26	78·9	73·94

	HYDERABAD AND MYSORE.						COASTS OF PENINSULA (EAST AND WEST).			
	Secunderabad (1787 feet).		Bellary (1455 feet).		Bangalore (2981 feet).		Madras (22 feet).		Goa.	
	Temp.	Rain-fall.	Temp.	Rain-fall.	Temp.	Rain-fall.	Temp.	Rain-fall.	Temp.	Rain-fall.
January, .	70·4	0·31	73·4	0·10	67·8	0·22	75·9	0·98	79·6	0·00
February, .	75·6	0·26	78·7	0·05	72·2	0·16	77·6	0·31	80·7	0·00
March, . .	82·0	0·77	85·4	0·60	76·8	0·63	81·0	0·44	83·4	0·01
April, . .	87·0	0·66	88·9	0·82	80·1	1·39	85·2	0·67	85·2	0·05
May, . .	88·3	1·49	87·7	1·90	78·4	5·07	87·4	2·33	86·1	2·64
June, . .	82·2	3·61	82·9	1·86	74·0	3·31	87·7	1·98	82·4	29·05
July, . .	77·1	5·75	80·6	1·45	72·2	4·06	85·6	3·80	80·0	28·99
August, . .	77·1	5·63	80·6	2·32	72·0	6·02	84·7	4·53	79·7	21·73
September,	76·4	5·08	79·6	3·69	71·9	6·56	84·2	4·80	79·6	13·73
October, . .	76·0	3·47	78·8	3·93	71·9	6·26	81·5	10·81	81·1	4·28
November, .	72·2	0·65	75·5	0·73	70·2	1·54	78·5	13·12	82·8	1·63
December, .	69·4	0·23	73·1	0·28	67·8	0·65	76·3	4·99	81·9	0·16
Year, .	77·8	27·91	80·4	17·73	72·9	35·87	82·1	48·76	81·9	102·27

CHAPTER II.

THE PREVALENCE OF FEVER IN INDIA, ITS FORMS AND TYPES.

The sources of our information respecting the pathology of India are —1st, The Annual Reports of the Sanitary Commissioners for the different Governments, which deal with the health of the civil population only; these we shall refer to as S. C. R. 2nd, The Reports of Sanitary Measures in India, which contain a *resumé* of the statistics bearing on the health of the civil and military populations, and the progress of sanitation throughout the country; these, when quoted, will be distinguished by the letters S. M. I. 3rd, The Annual Army Medical Reports, which deal with the health of the European and native troops. 4th, Indian medical journals, special reports, and standard works on Indian diseases.

The Reports of the Sanitary Commissioners furnish us with the deaths from fever, and other diseases, occurring among the civil population in each of the districts and registration circles into which the Governments are divided. Nothing could be more satisfactory, if the system of registration were at all perfect. Unfortunately, as I have already stated, this cannot be said to be the case, although great advances in this respect have been made of late years, and I shall confine myself chiefly to the statistics of recent years, and of those Governments for which the returns are most reliable. The total deaths registered represent with sufficient accuracy the total mortality. It may be assumed, also, that the census returns of the population furnish for these provinces a reasonably sound basis for calculating the proportion of deaths to the population. The chief defect of the vital statistics of the civil population undoubtedly lies in the uncertainty respecting the assigned causes of death.

Dr. Browne, of Hoshangabad, having inquired into the history of 77 deaths ascribed to fever, came to the conclusion that only 32 of them were so caused. Of 150 deaths registered from fever, investigated by the civil surgeon of Chanda, only 41 appeared to him really to have been fever deaths.[1] A considerable number of the

[1] *S. C. R.*, Central Provinces, 1884, p. 14.

cases registered as having died of fever, were found, on inquiry, to have been cases of bowel complaints or of chest affections. It is evident, however, that an inquiry into the cause of death, made some time after the event, is not likely to lead to any trustworthy result. It must also be remembered that, in a malarious country, bowel and chest affections, if not the result of malarial fever, are often complicated with it. Scientific accuracy, or any close approach to it, cannot be claimed for these returns; yet I think they afford a useful measure for estimating the comparative prevalence of fever in different localities, seasons, and years; and I come to this conclusion from the following considerations:—(*a*) The same districts give, over a series of years, comparable returns of fever mortality. (*b*) Districts known to be extremely malarious furnish, upon the whole, correspondingly high returns of fever mortality. (*c*) The appearance of an epidemic in a given locality is signalised by a rise in the fever death-rate of that locality, and this rise occurs during the months when the epidemic breaks out, and fluctuates with its increase and decline. (*d*) The deaths ascribed to fever rise proportionally in the months when fever is known to prevail.

The admission and death rates of the European and native troops being determined by skilled diagnosis, are accurate, and serve to check, and must be used to correct, the results obtained from the civil records. For the mortality caused by other diseases, we shall rely chiefly on the Army Medical Reports, and on the statistics of the jails and hospitals.

Throughout the whole of India there is no province, or extensive district, entirely free from malarious diseases.

In the Punjab, for example, in 1883, out of 446 registration circles, all returned fever deaths, with one exception, and it is by no means to be assumed that the inhabitants of this favoured circle were entirely free from malarious illness during the year.

In Bengal, again, during the same year, fever deaths occurred in all the 648 registration circles, and in Bombay all the districts and all the towns returned deaths from fever. Nor does this represent an abnormal state of things; it is the rule. The military returns corroborate the statistics of the civil population as respects the general diffusion of the disease. At no station occupied by European or native troops are paroxysmal fevers wanting. We are therefore justified in saying that malarial fever is more or less prevalent throughout India. Not only is it everywhere met with, but while it is much less prevalent and fatal in some regions than in others, it is everywhere the principal cause, or one of the principal causes, of death.

In the year 1883, which we have already referred to, out of 5,595,648 deaths which occurred in India from all causes, 2,883,101, or more than one-half, are ascribed to fever. If we allow that these figures exaggerate, as undoubtedly they do, the deaths actually caused by malarial fever, it is probable that they inadequately represent the mortality directly and indirectly caused by malaria.

It is a favourite expression of some authors, in reference to unhealthy countries, that "malaria dominates the pathology of such and such a place." We may safely say that malaria dominates the pathology of India. In the armies,—native and European,—composed of picked men of military age, fever is less fatal than in the general population. Still, in both armies a high proportion of the total deaths are ascribed to fevers. Thus, in the period 1867–76 (excluding cholera and accidental deaths), fevers accounted for 25·8 per cent. of the total deaths in the native Bengal army, and 21·2 per cent. of the deaths occurring among the European troops stationed in Bengal.

The following tables show the comparative prevalence of malarial fevers in the different civil divisions of India:—

MEAN OF THE YEARS 1881–84 INCLUSIVE.

Punjab,	19·92	Berar,	15·69
North-West Provinces, and Oudh,	23·25	Madras,	7·08
Bombay,	16·10	Mysore,	8·22[1]
Lower Bengal, excluding Calcutta,	14·52	Coorg,	14·76[1]
Calcutta,	8·32	Assam,	13·13
Central Provinces,	18·27	British Burma,	7·72

The comparative fatality of malaria in the various parts of the Bengal Presidency, and its increasing intensity towards the north-west, is further shown by the proportion which fever deaths bear to the total mortality among the native troops in the different regions of Bengal, as given by Bryden.

DIED OF FEVER OUT OF EACH 100 DEATHS FROM 1867 TO 1876 (CHOLERA AND VIOLENT DEATHS EXCLUDED).

Bengal.	Gangetic Provinces.	Meerut and Rohilkund.	Punjab.	Punjab Frontier.
22·6	22·7	26·0	28·0	27·1

The prevalence, as distinguished from the fatality, of the two forms of malarial fever among the native troops at representative stations from Assam westwards, is shown in the subjoined table, giving the admission rate per 1000 for the ten years 1867–76:—

[1] Means of the years 1882, 1883, and 1884 only.

	Dibrugarh.	Barrackpore.	Lucknow.	Bareilly.	Ferozepore.	Jhelum.	Peshâwar.
Intermittent,	802·1	685·2	416·6	193·6	949·9	603·3	1337·9
Remittent and Continued,	6·6	13·2	5·9	8·3	2·5	8·3	16·5

The next table, which is intended still further to illustrate the incidence of malaria on the different regions of India, gives the admissions and deaths among the European troops, per 1000 of strength, from paroxysmal fevers in the various military circles of Bengal and Bombay for the years 1881 to 1886 inclusive, and of Madras for the years 1882 to 1886. The stations have been arranged so as to correspond as nearly as possible to the civil divisions given above:—

Bengal.			Madras.[1]			Bombay.		
	Admissions.	Deaths.		Admissions.	Deaths.		Admissions.	Deaths.
Presidency,	277·8	0·56	Eastern District,	38·44	0·00	Presidency,	225·4	0·57
Allahabad, .	313·4	1·05				Sind, . .	600·2	1·31
Oudh, .	188·1	0·15	Western District,	19·21	0·00	Poona, .	299·9	0·51
Rohilkund,	301·8	0·60				Mhow, .	647·5	0·94
Saugor, .	489·7	0·59	Mysore, .	67·39	0·14			
Gwalior, .	778·0	0·29	Hyderabad,	49·14	0·15			
Meerut, .	768·4	0·45	Nagpore, .	398·61	0·51			
Sirhind, .	322·4	0·88						
Lahore, .	959·7	1·05						
Râwal Pindi,	350·1	0·62						
Peshâwar, .	763·6	0·70						

Both the civil and military statistics concur in showing that Madras is more healthy than either Bengal or Bombay, and that the delta of the Indus and that of the Ganges are less malarious than the north-western districts of India.

It must be observed that the table of fever deaths in the general population includes all non-eruptive fevers. Deaths from enteric and other forms of continued fever are thus grouped together. The returns of the European army, given above, refer to paroxysmal (malarial) fevers only.

The total fever mortality of the European army, although considerable, is insignificant compared with that of the civil population. The explanation of this will be considered as we proceed. In the meantime, it is necessary for future reference to point out the annual variations in the death-rates from enteric fever and malarial fever respectively, in the armies of the three Presidencies, for a series of years:[2]—

[1] In 1885 some changes were made in the arrangement of the Western District, to which Belgaum was added. A minor change also took place in the Mysore District, but not of such a nature as to affect the result.

[2] *S. M. I.* 1884, p. 52.

ANNUAL VARIATIONS IN THE DEATH-RATES FROM ENTERIC FEVER AND MALARIAL FEVER IN THE EUROPEAN ARMIES OF THE THREE PRESIDENCIES.

Presidencies.	Fevers.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.[1]	1882.	1883.	1884.	1885.	1886.	1887.	1888.
BENGAL, .	Intermittent, Remittent, and Continued, .	2·25	1·78	1·39	1·10	1·18	0·71	0·66	1·59	2·63[1]	2·66[1]	0·81	0·77	0·44	0·36	0·60	0·99	0·76	0·34
	Enteric, . .	1·71	1·62	1·53	2·01	1·59	1·75	1·55	4·69	3·86[1]	3·07[1]	2·62	2·90	2·52	3·31	4·05	5·70	4·09	4·15
	Total, .	3·96	3·40	2·92	3·11	2·77	2·46	2·21	6·28	6·49[1]	5·73[1]	3·43	3·67	2·96	3·67	4·65	6·69	4·85	4·49
MADRAS, .	Intermittent, Remittent, and Continued, .	0·83	0·69	0·70	0·17	0·36	0·46	0·27	1·11	0·76	0·39	0·19	0·27	0·28	...	0·19	0·89	0·51	2·19
	Enteric, . .	1·47	2·34	0·78	1·04	0·63	1·99	2·00	1·20	1·44	1·36	0·58	2·09	2·86	1·67	2·19	3·85	2·98	2·26
	Total, .	2·30	3·03	1·48	1·21	0·99	2·45	2·27	2·31	2·20	1·75	0·77	2·36	3·14	1·67	2·38	4·74	3·49	4·45
BOMBAY, .	Intermittent, Remittent, and Continued, .	1·01	0·74	0·56	0·76	1·28	0·29	0·50	1·12	1·61	3·23	0·91	0·81	0·73	2·14	1·49	0·27	0·90	0·34
	Enteric, . .	1·48	2·22	1·31	1·33	1·77	1·86	1·39	2·55	1·93	5·76	2·83	1·90	1·55	2·05	2·54	4·16	3·40	4·04
	Total, .	2·49	2·96	1·87	2·09	3·05	2·15	1·89	3·67	3·54	8·99	3·74	2·71	2·28	4·19	4·03	4·43	4·30	4·38

[1] Excluding troops in Afghanistan.

The average death-rate from intermittent, remittent, and continued fevers on the one hand, and from enteric fever on the other, for the ten years 1870–79, in the European army of India and in each of the three Presidencies, stands thus:—

MORTALITY FROM ENTERIC FEVER AND OTHER FEVERS.

	During 1870-79.		
	Enteric Fever.	Malarial Fevers.	Total of both.
Army of India, . . .	2·03	1·42	3·45
,, Bengal, . .	2·28	1·74	4·02
,, Madras, . .	1·42	0·62	2·04
,, Bombay, . .	1·75	1·14	2·89

The proportion of fever deaths among the civil population, whatever allowance may be made for registration errors, is enormously larger than that of the military, European or native. In the year 1884 no less than 16·70 per 1000 of the population is stated to have died of fever. In the same year only 0·64 of the European troops died of intermittent, remittent, and continued fevers. If we include enteric fever along with the malarious affections, the total fever death-rate of the English army amounted to 3·38. The total fever death-rate of the native troops, who are little liable to enteric fever, was, for the same year, 1·80 per 1000.

The explanation of this difference between the civil and military populations as respects the mortality from fever is not difficult to find. A large proportion of fever deaths in India, as in all malarious countries, occurs among infants and children. In Bombay, for example, out of 5186 deaths from remittent fever in 1885, 1193 occurred among children under three years of age. The troops consist of men who have attained a period of life when they are better able to withstand the attacks of malaria.

The troops,—native and English,—except when on active service, are less exposed to some of the conditions which increase the fatality of malarious fevers. And when engaged on active service, with its fatigues and exposure, the death-rate of the troops—especially that of the native army—rises at once. To begin with, the native soldiers are picked men; they are better clothed, fed, and housed, are placed under better sanitary conditions, and, when sick, are better treated, than the natives generally. The English soldier enjoys the same advantages, and has the additional one of being able, in many cases, to escape death by being invalided home.

The native population suffers from poverty, hardship, and scanty clothing; being often insufficiently fed, and compelled to dwell in malarious localities, in badly constructed, overcrowded houses, and being destitute, in many localities, of skilled advice when sick, it is no wonder that they succumb to fever in a much larger proportion than the troops.

The forms of malarial fever prevailing in India are the intermittent, remittent, and the continued. Among the natives the intermittent is by far the most common, but the remittent is by far the most fatal. Among the European troops the continued form, according to Waring,[1] is the most common. He gives the proportion of admissions to strength in the two armies in Madras for the ten years ending 1838, from which I deduce the following ratios per cent. of the different types of fever treated:—

	European Troops.	Native Troops.
Ephemeral Fever,	6·0	21·4
Continued,	45·9	3·5
Intermittent,	36·2	69·3
Remittent,	11·9	5·8
	100·0	100·0

For the twenty years ending 1850, the same authority states that of 160,128 cases of fever occurring amongst the European troops of Bengal, the proportions were:—

Remittent,	22·3
Intermittent,	33·7
Continued,	44·0
	100·0

Waring points out that the continued form of fever is that most commonly met with among the European troops in India. The figures show, as regards Madras, that the continued forms are in excess of the paroxysmal; but the contrary is the case as respects Bengal. Of late years paroxysmal fevers show a preponderance in all the Presidencies. Thus in the Madras Presidency, during the period 1871–80, out of an average of 2952 fever admissions, 831 were for simple continued fever, 491 for febricula, 176·8 for remittent fever, 1413 for ague, and 39·3 for enteric fever.

It would appear that in the warm and equable regions the continued forms predominate; in the elevated regions, with a high range of temperature, the intermittent form is out of all proportion the most common. Thus, along the coasts of Madras, comprising the Eastern and Western Districts, the continued form is usually more common than the intermittent; while at Nagpur, on the table-land,

[1] *Indian Annals of Medical Science*, April 1856.

at a high elevation and with a great range of temperature, paroxysmal forms are in great excess.

The proportion in which the various types of intermittent fever occur, varies somewhat in the different regions of India, but everywhere the quotidian is the most common. In Sind, out of 537 cases observed by Inglis, 531 were quotidian and 6 tertian—in other words, 98·9 per cent. of all cases met with in this province are of the quotidian type. Of 53,753 cases observed in Bengal amongst European troops, the types and ratio of deaths were:—

	Ratio of Types.	Deaths per cent. to Treated.
Quotidian, . .	95·5 per cent.	1·259
Tertian, . . .	3·9 ,,	0·573
Quartan, . .	0·6 ,,	0·542

At Secunderabad, out of 902 cases observed, 774 were of the quotidian type, 124 tertian, and only 4 were quartan. At Mhow, according to Impey, there were only 55 quotidians to 49 tertians and to 4 quartans. At Bombay the proportions in 73 cases reported by Leith were 43 quotidian, 29 tertian, and 1 quartan.

That form of bilious remittent known as jungle fever requires a short description, from its analogy to the same disease observed in the United States and other malarious countries. When a premonitory stage exists, the symptoms observed are nausea, headache, pains in loins and limbs, oppression at the præcordia, and mental dejection. In some cases, without any previous indisposition, the patient is attacked with delirium and with vomiting. In other cases, and these are the most numerous, the scene opens with rigors, followed by fever. In whatever way it commences, the paroxysm is marked by rapid pulse, burning skin, thirst, pain at the stomach, and bilious vomiting. The countenance is flushed, the eyes red and suffused; there is intense headache, and often delirium. After twelve hours or more, profuse sweating breaks out, and an amelioration of all the symptoms occurs; but the patient remains in a state of great debility. After an interval of varying duration, an exacerbation occurs, usually without rigors, during which the symptoms of the first paroxysm are repeated, either in a mitigated or aggravated form, according to the intensity of the disease and the influence of treatment. If the disease progresses, the remissions become shorter and less marked, and the disease tends to become continuous. The vomiting often persists, the tongue becomes dry, black, and crusted, the debility more extreme, and the mind wanders. If the disease is tending to recovery, the paroxysms become less severe, the remissions more distinct, and it

may either pass off from the fourth to the seventh day, or terminate in intermittent.

The various forms of pernicious attack, observed elsewhere, are met with in India; but I am unable to give details of their relative frequency in the different regions of India. The choleraic form is stated to be of rather frequent occurrence on the Afghan frontier.[1]

The typhoid form of malarial remittent or continued fever is far from rare. It is readily mistaken for enteric fever. It usually runs a course of a fortnight or three weeks, the patient generally exhibiting the group of symptoms designated as typhoid. In fatal cases, in addition to the lesions characteristic of malarial fever, there is marked congestion, and sometimes softening of the duodenum; and this morbid condition may extend to other parts of the intestinal tract.

Other complications are by no means wanting. Firth says that out of 1033 cases of intermittent fever, 26, or 2·5 per cent., were accompanied with jaundice; none with icteric urine; and only 11, or about 1 per cent., with hæmatinuria. Of 221 cases of true remittent, 4 had well-marked jaundice; 2 had jaundice with hæmatinuria; and 2 had jaundice, hæmatinuria, and icteric urine.

The seasonal distribution of malarial fever has to be considered in reference to race, region, climate, and the form of the disease.

The following, according to Bryden, is the monthly distribution per cent. of the deaths from fevers of all kinds in the European and native armies of Bengal for the period 1867–76:—

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
European Army,	4·0	4·3	3·3	7·5	12·2	11·6	8·6	12·1	14·6	9·7	7·2	4·7
Native Army,	11·6	9·1	9·0	5·8	5·5	5·9	5·2	6·1	5·5	9·5	14·5	12·2

The predominating influence of the intermittent element in the native army, and that of the remittent and continued types and of enteric fever in the case of the European troops, is to be clearly traced in these figures.

Intermittent fever is everywhere in the plains of India an autumnal disease. In some of the hill stations, as will afterwards be shown, malarial fever becomes vernal; and in many localities a minor spring rise is observable. The exact month when the maximum of admissions occurs varies in different parts of the peninsula. In Bengal it almost uniformly falls on October, if the average of a few years be taken; but the period of the maximum in individual years is regulated to a considerable extent by the

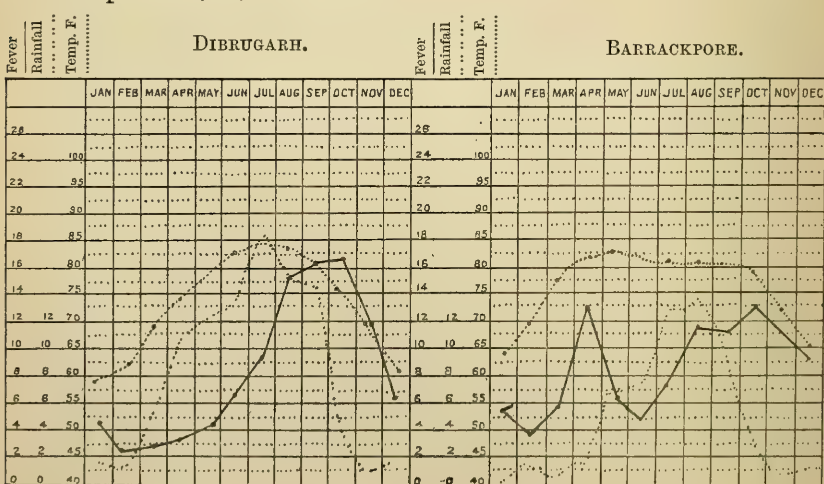
[1] Crawford, *Army Medical Report*, 1880.

temperature, and, above all, by the greater or lesser intensity of the disease, which anticipates in epidemic seasons, and also in non-epidemic seasons, in localities in which for special reasons malaria may happen to be unusually prevalent.

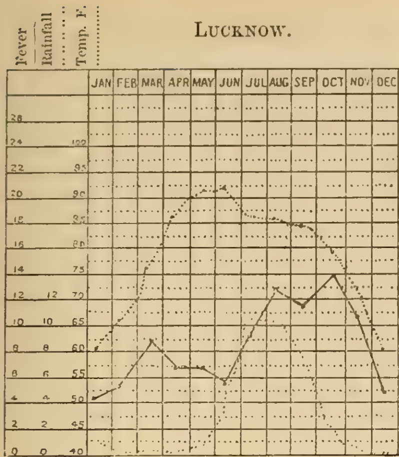
The general course, however, of the seasonal evolution of intermittent fever appears to be to a considerable extent determined by the thermal curve. The prevalence of the disease, other things being equal, is in proportion to the mean temperature of the summer months, and its monthly distribution is also modified by the amplitude of the thermal curve. When the temperature in a given region maintains for several months a pretty uniform level, the fever curve tends to follow the same form. When, on the other hand, the temperature falls rapidly and steadily after attaining its maximum, so that the ascending and descending lines of the curve form the sides of an angle, having a more or less distinct apex at the point where the maximum is attained, the fever curve exhibits the same peculiarities.

The normal annual evolution of the malarial element in the pathology of India is certainly not to any large extent determined by the periods of rainfall. The extent to which the normal seasonal periodicity, essentially independent of rainfall, may be modified by it, and the influence of the amount and season of the rainfall on the prevalence and intensity of fever in different localities, will be fully considered in the following chapters.

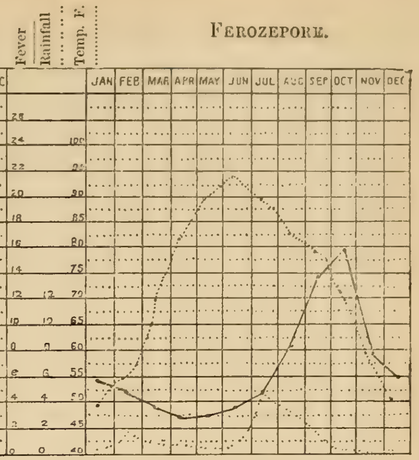
The relation of the normal fever curve to temperature and rainfall is illustrated in the following diagrams, representing the percentage of fever admissions, ——; the rainfall in inches, ...; and the temperature, F., ... :—



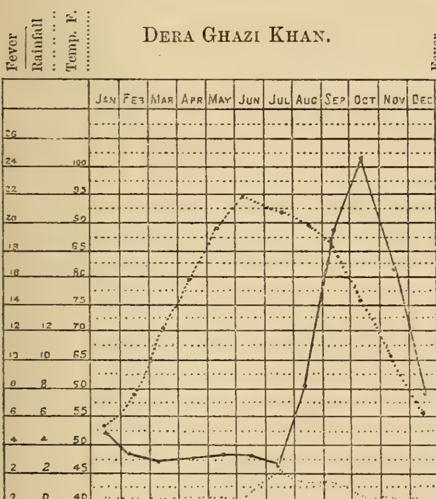
LUCKNOW.



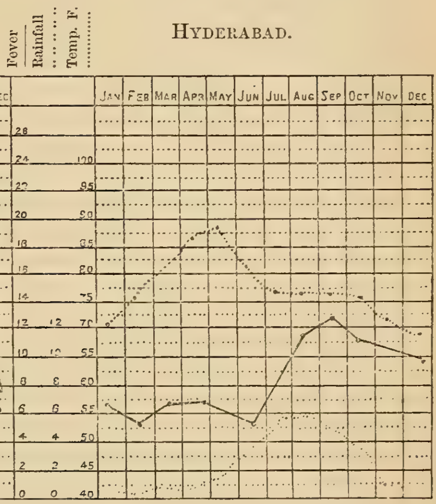
FEROZEPORE.



DERA GHAZI KHAN.



HYDERABAD.



The monthly distribution of the remittent and continued types amongst the native troops exhibits two marked maxima—the first in April, May, or June, the second in September, October, or November. In Lower Bengal the first period is that which is most distinctly marked; while in the west of the Punjab, at Jhelum and Dera Ghazi Khan, the spring rise almost disappears, and the maximum occurs in different localities from October to January. In fact, on the North-West Frontier these four months marshal into line the whole category of malarial fevers, dysentery, and respiratory diseases; and, what is more remarkable, diarrhœa, notwithstanding the low temperature, joins to swell the endemo-epidemy. This does not

hold, however, as regards the European troops, amongst whom these forms are here most prevalent in the summer or early autumn months.[1]

Malarial fever frequently assumes an epidemic form in India. The record of these outbreaks is far from complete, especially as regards their extent, their severity, and the order in which the different regions have been successively invaded. The following are the epidemies chiefly affecting the Bengal Presidency mentioned by Bryden. In the year 1807 fever was epidemic in Chota Nagpur. It began in August, and was at its height in September. In the two following years it appears to have extended to the North-West Provinces, and probably also to the Punjab. In 1816–17 fever was epidemic in Saharanpore, and generally in the Gangetic plain. It is said to have been of the bilious remittent type; but it is probable that much of this epidemy was of relapsing fever. Fever was epidemic in the Gangetic districts in 1828, and at Delhi and the country to the west in 1829. In 1834–36 fever was very prevalent in Western Rajputana, Nasirabad, Neemuch, and Mhow. Malarial fever was epidemic over the whole of Northern India in 1843–44; Southern Sind, however, was only moderately affected. The disease was severe at Sukker and also at Kurnaul; the latter, long regarded as healthy, was specially affected during this outbreak. The fever of 1844 reappeared during the monsoon of 1845–46, infesting Umballa and Ghazipore.

The years 1850–51, 1863, 1866-67, and 1869-70, were years when fever was extensively epidemic in India. Some of the later epidemies will be considered in detail in the sequel.[2] The years 1834–35 and 1843–45 were noted fever years in Madras, and 1836–37, 1839, 1844, 1849, and 1852 in Bombay.[3]

Bryden believes that fever epidemies begin in Lower Bengal and Chota Nagpur, and then invade Northern and Western India. Among other instances, he states that fever was epidemic in Calcutta in 1833, appearing in Upper India in 1834. The great outbreak

[1] Crawford says that the fevers prevalent in Pesháwar and Khyber valleys are of the continued type in the hot weather, while in autumn and commencing winter ague and remittent fevers are the most frequent.

[2] Our information respecting severe local outbreaks of fever is extremely imperfect, yet some of these are of great interest. We read, for example, of an epidemy that raged in Behar in the latter months of 1859, of which it is said: "There exists in the memory of the oldest inhabitant, or even in tradition, no recollection of any disease occasioning such a mortality." In this epidemy it is stated that in one locality death resulted from exhaustion following perspiration. Was this fever analogous to the sweating sickness? Ganjam suffered from a very fatal epidemic fever in 1815-16, an account of which will be found in the *Madras Quarterly Journal* for 1843.

[3] *Ind. Annals Med. Science*, October 1885 and April 1856.

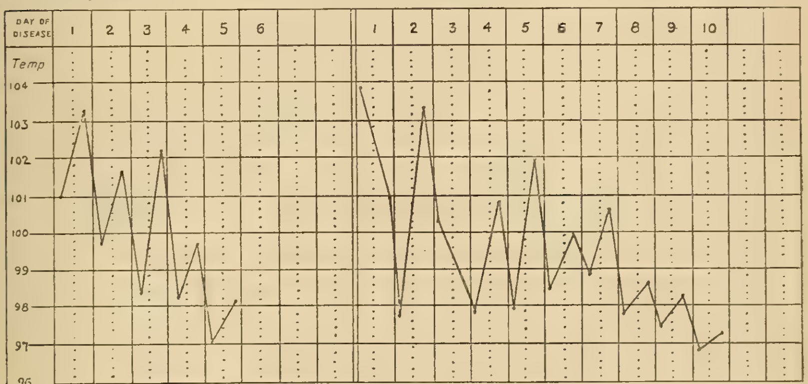
in Agra and Northern India of 1856 was also preceded by an epidemic extension of the disease in the East. This is a seductive theory; but the records of past epidemics, although they seem to give it some support, are too scanty and imperfect to furnish conclusive evidence for or against it. It is not a rule without exception, although, so far as can at present be ascertained, malarial epidemics, more frequently than otherwise, take the course described by Bryden.

I add a few temperature charts exhibiting some of the types of fever observed in the North-West of India.

The two following charts, 1 and 2, represent mild forms of malarial fever, such as constitute the bulk of cases treated in all but the worst fever seasons. Chart 1 is a case of tertian fever which was cut short after the second paroxysm. Chart 2 represents a mild case of irregular type.

I.
MULLOO, age 19. Short attack, tertian type. Admitted, Nov. 3, 1890; discharged, Nov. 11, 1890.

II.
GHARSITA, age 30. Short attack, irregular type. Admitted, Nov. 5; discharged, Nov. 15, 1890.



Charts 3 and 4 represent two febrile attacks in one patient, separated from each other by an apyrexial period lasting about a week.

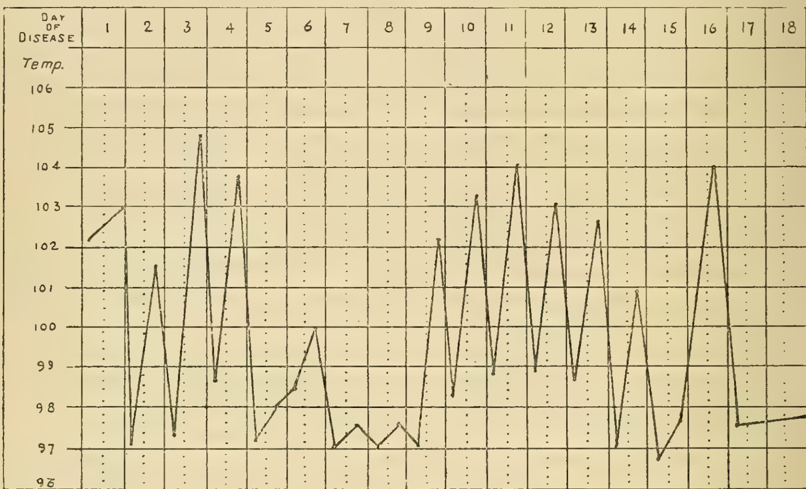
The type throughout is quotidian remittent, although the tertian impress, bearing evidence of, at least, a distinct malarial element in its character, is to be noticed, especially in the second attack, during the course of which there is exhibited a tendency to more perfect remissions every other day, as will be seen by the asterisks denoting tertian periods.

The ladder-step rises of temperature, as seen in No. 4, are associated with an obstinate form of the disease, which often develops congestion of the liver and lungs, and symptoms which for the sake of convenience may be designated as typhoid. I am not

aware that typhoid lesions are ever found in the form of fever, but its morbid anatomy demands further investigation.

III.

Gami, age 26. Irregular intermittent. Admitted, Sept. 2, 1890. This first period of fever continued until October 7. See No. 4.



IV.

Gami, age 26, Sialkote. Quotidian remittent, with remissions every other morning, ending in irregular intermittent. The disease commences with ladder-step rises in the temperature. The asterisks indicate tertian morning falls in the temperature. The first day of fever corresponds to October 13, 1890. Continuation of No. 3.

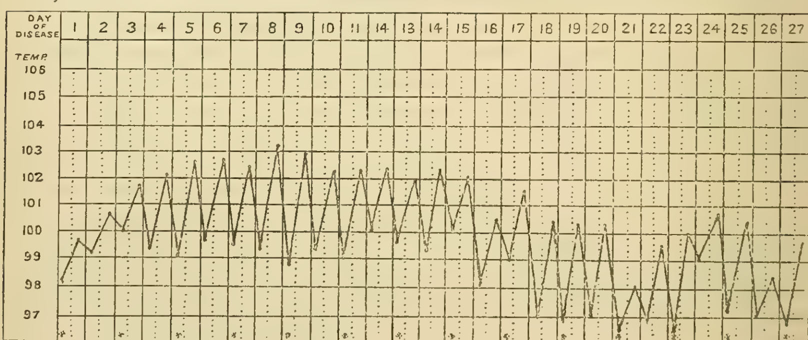


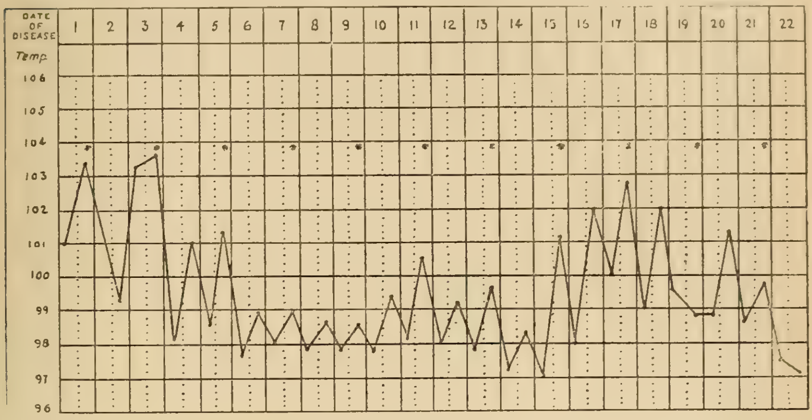
Chart No. 5 is a case of quotidian remittent and intermittent. This form is specially liable to recur after the patient has been for several days free from fever.

Charts 6 and 7 exhibit two common forms of quotidian remittent. In case 6 the temperature attains it maximum on the first day, and a ladder-step fall in the morning temperature indicates a favourable issue and short course. In Chart 7 the maximum is attained on the second day, after which the evening temperature remains uniform, while the morning remissions become less marked

each successive day. On the fifth day a marked fall of temperature takes place, after which the fever continues on a lower grade until the morning of the eighth day, when it gradually decreases.

V.

MEHRDIN, age 28, farmer. Intermittent fever, irregular. The asterisks mark the tertian periods. It will be seen that the exacerbations tend to recur at intervals to the tertian type.

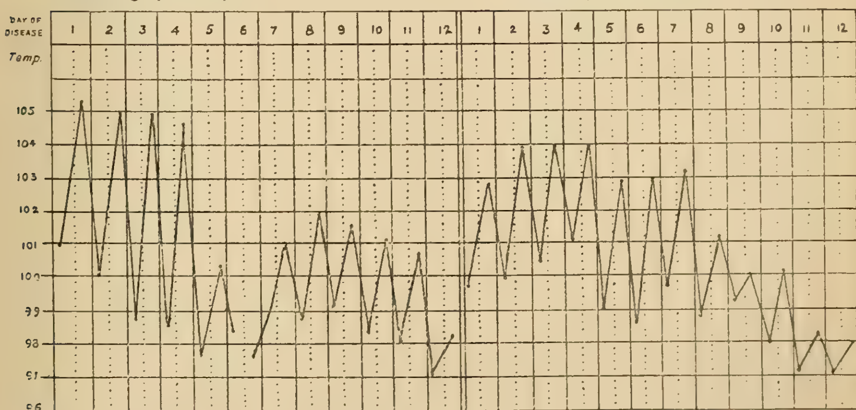


VI

NUBBIA, age 22, farmer, six months in prison. Quotidian remittent. Admitted, Oct. 16; discharged, Oct. 30, 1890.

VII.

SHER SING, age 20, farmer, one year in prison. Quotidian remittent. Admitted, Oct. 16; discharged, Oct. 30, 1890



Charts 8, 9, and 10 represent fatal cases of quotidian intermittent fever, the chief symptoms in all being vomiting and diarrhœa.

Chart 11 shows the course of a case of irregular remittent, which became complicated with congestion of the lungs on the sixteenth day. It persisted, notwithstanding the administration of quinine, for thirty days.

VIII.

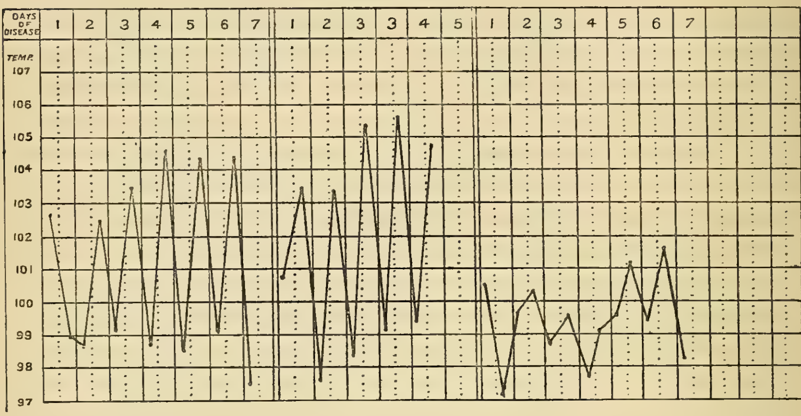
Natho, age 28. Chief symptoms: fever, purging, and vomiting. Treatment: quinine, astringents, and stimulants. Admitted, Sept. 29; died, Oct. 5, 1890.

IX.

Hera, age 38. Chief symptoms: fever, purging, and vomiting. Treatment: quinine, astringents, stimulants. Admitted, Sept. 30; died, Oct. 5, 1890.

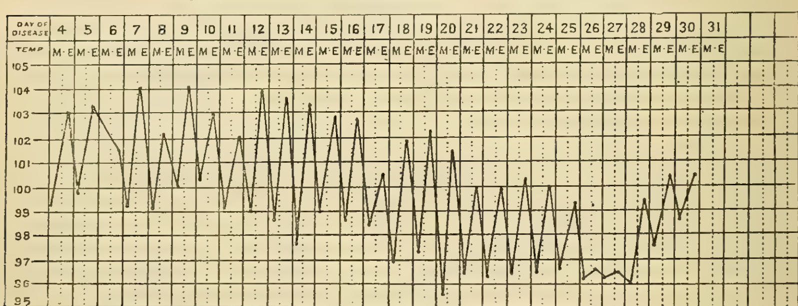
X.

Praun, age 46. Chief symptoms: fever, purging, vomiting. Treatment: quinine, astringents, stimulants. Admitted, Sept. 29; died, Oct. 5, 1890.



XI.

Dya Singh, age 60. Symptoms: fever, complicated with congestion of lungs from the sixteenth day of the disease. Admitted, Sept. 29; died, Oct. 26, 1890.



Having thus briefly glanced at the place occupied by fevers generally in the pathology of India, their incidence on the civil population and on the troops,—native and European,—we shall proceed in the following chapters to consider in more detail the endemic and epidemic prevalence of malaria in the several Governments, in relation to climate and other conditions; after which enteric fever and other diseases will be treated of in the usual order.

CHAPTER III.

EPIDEMIC AND ENDEMIC MALARIA IN THE PUNJAB.

The following statement gives the ratio of fever deaths per 1000 of the population in the Punjab during the eleven years ending 1887, and the mean rainfall of thirty-two stations [1] for each year from 1877 to 1884, and of thirty-one stations from 1885 to 1887:—

Years.	Annual Fever Death-rates.	Rainfall, Inches.	Years.	Annual Fever Death-rates.	Rainfall, Inches.
1877,	12·54	29·1	1883,	16·25	21·9
1878,	25·19	30·5	1884,	24·71	26·9
1879,	27·04	23·5	1885,	18·40	26·7
1880,	18·74	21·8	1886,	17·85	29·1
1881,	20·32	26·4	1887,	23·78	24·1
1882,	18·40	26·5			

The mean death-rate for the eleven years was 20·29; the mean rainfall, 26·05 inches.

We shall consider in detail the various circumstances affecting the epidemic and endemic prevalence of malaria in this government, and at the same time glance at the influence of meteorological conditions on the spread of epidemic malaria in India as a whole.

The above table shows that the Punjab has a high mean fever mortality, but one fluctuating greatly from year to year. The lowest fever death-rate was in 1877, a year of moderate famine, marked by heavy rains in the earlier part of the year, a scanty rainfall in July and August, and a moderate rainfall in September, followed by rainy weather.

The highest fever death-rate was in 1879. This year is thus described: "Rains bad. Crops below average. Prices high, but great demand for labour. Health worse than in 1878. Fever, smallpox, and cholera epidemics." [2] Let us see how far this

[1] The rainfall for the years 1884–87 are from *S. C. R.* for each of these years; the others are deduced from a table of the aggregate rainfall in the *S. C. R.* (Punjab) 1883, dividing the total fall by thirty-two, which is the number of stations.

[2] *Report on the Sanitary Administration of Punjab*, 1883, p. 7.

high fever mortality can be explained by the meteorology of this year.

I find that the temperature during the first five months of 1879 in the Punjab was high. Up to the end of May the rains were scanty. June was rainy; the July rains were below the normal, the August rains above the normal; September, October, and November very dry; the December rains normal.

I see nothing in the amount or distribution of the rainfall that explains satisfactorily the altogether exceptional mortality of that year. It is thought by some that abnormally dry weather in September, October, and November following the rains of June, July, and August tends to the increase of fever. But it will be observed that the following year, 1880, which had a fever mortality considerably below the mean, had very much the same meteorological characters as those of 1879. In 1880 the earlier part of the year was dry, as were also the months of September, October, and November. In order to understand the extreme unhealthiness of the Punjab in 1879, it is necessary to consider it in connection with the meteorology and health of the peninsula generally at that time.

Respecting the meteorology of this year, Blandford says: "The rainfall was below the average in the Punjab, Western Rajpootana, and Sind, also in the Gangetic delta and Western Bengal. In all the other provinces it exceeded the average, and specially so in the Gangetic plain, comprehending the North-West Provinces and Behar. This excess was due entirely to the very copious rainfall of the summer monsoon, for both the earlier and later months of the year were remarkably dry.

"*Air Temperature.*—The mean of all stations slightly below average, but it was by no means generally so in Northern India. In the North-West Provinces and Bengal the mean temperature of year was slightly excessive, and in the Punjab this was the case at as many stations as show the opposite variation. This excess was due to the preponderance of the high temperature of the first five months of the year. . . . In Rajpootana and the Central Provinces the great depression of the closing months more than counterbalances the excess of temperature in the earlier months, and in the Deccan and the peninsula generally a depression of temperature characterised the greater part of the year. In Burma and Arakan only the first three months of the year showed an excess of temperature."

From the above it appears that the climate of the Punjab in 1879 was marked by a low rainfall and a high temperature from January to May; that of the North-West Provinces by an excess of rain in summer, with a high temperature in the earlier

part of the year. In the Central Provinces and eastern Rajputana there was an excess of rain for the year; in western Rajputana the rainfall was deficient, and in both regions there was a defect of temperature in the closing months. From the Bombay meteorological returns we learn that in Gujarat, the Konkan, the Sahyádri range, North, South, West, and East Deccan, the rainfall in 1879 was above the normal. In Sind only was it below the normal.

Now, in 1879, fevers prevailed in an epidemic form not only in the Punjab, where the rain was scanty, but also in the North-West Provinces and in many parts of the Bombay Presidency, where, as we have seen, the rainfall was above the average. From the military returns we find that at Haiderabad in Sind, where the rains in that year were below the normal, the admissions from paroxysmal fevers were 1201·0 per 1000 compared to 810·3 per 1000 in 1878, and 595·1 per 1000 in 1877.

Baroda, Indore, Neemuch, Satara, Poona, Mhow, Ahmednagar, Nasirabad, Karachi, all with an excess of rainfall, equally with Haiderabad, where the rains were scanty, returned excessive admissions that year from paroxysmal fevers. In Madras the deaths from fever among the civil population were 285,477 as against a ten years' average (1872–81) of 268,798. In the *Army Medical Report* it is stated that the rains "at some stations, if not generally," were heavy, and the admissions from paroxysmal fevers were about a third greater than in 1878. Fever is also stated to have been unusually prevalent in Rajputana, and it was certainly so in British Burma. In Lower Bengal, the Central Provinces, and Berar, the mortality from fever in 1879 was under the average. It is evident that we are here in presence of a wide-spread outbreak of malarial fever, and it would be futile to seek for a full explanation of the Punjab fever death-rate in the local meteorology of that province, although this may not have been without its influence on its intensity and its local distribution. But we see here a general outbreak of fever occurring under very diverse conditions of temperature and rainfall. If in the Punjab the rainfall was scanty and abnormally distributed, we are not to forget that fever raged that year with great severity in many parts of Bombay and Madras, where the rains were heavy. The mean temperature of the year was slightly excessive in the North-Western Provinces and at many of the Punjab stations, but it was so also in Bengal, which was exempt from the epidemy of 1879.

But this epidemy of 1879 cannot be fully understood without considering the fever history of the two previous years. The year 1877 was a disastrous year in Madras. The registered fever deaths

rose to nearly double the average, but the mortality was due in a great part to the famine. The total rainfall in Madras, Mysore, and Hyderabad was in excess of the normal, but the earlier months of the year were, as a rule, excessively hot and dry. The south-west monsoon was late, and even scanty; the north-east monsoon was copious. In Madras a cyclone in the middle of May, lasting for three days, was accompanied by a fall of 22 inches.

The year was a fairly healthy one for the military throughout the Presidency; this will be seen by examining the admission-rate of the European troops from paroxysmal fevers for the years 1876–79:—

Years.	Presidency.		Mysore.		Hyderabad.		Burma.	
	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.
1876,	40·2	0·00	28·50	0·00	102·90	0·30	23·40	0·00
1877,	57·06	0·46	31·70	0·00	129·27	0·00	38·99	0·00
1878,	306·24	0·97	54·03	0·41	204·22	0·89	86·50	1·06
1879,	505·51	0·65	112·52	0·00	392·28	0·64	163·96	0·36

A slight rise in the fever admission-rate is observed to have taken place in 1877 at all the stations in Madras. In Bengal, on the other hand, the fever admission-rate was lower in 1877 than in 1876 in every circle from Calcutta to Pesháwar, excepting in Oudh, where there was a slight excess. The fever mortality was also remarkably low that year in the Central Provinces and Berar. The same low rates of fever admissions also obtained among the troops stationed in the Bombay Presidency. The city of Bombay was visited with a severe outbreak of fever, and the fever mortality among the civil population throughout that Government was high. These facts point to the conclusion that malarial fever was not epidemic in any extensive region of India in 1877, with the exception of Bombay.

It is different when we come to the year 1878. Now we find paroxysmal fevers to prevail in Madras and Burma, and the increase in the fever admission-rate is seen to be accompanied by a marked rise in the death-rate. This year, again, we find the fever prevailing under different meteorological conditions. At Bangalore, in Mysore, the rains were very heavy. At Hyderabad they were much above the normal, while at Madras itself they were 19 inches

under the normal. The rainfall in British Burma was much below the normal. But equally where there was excess or defect of rainfall, fever was epidemic. In the Bengal command a great increase in the fever admissions is signalised in every military division, except in Allahabad and Oudh. In some places, as at Jullundur and Ferozepore, this increase is ascribed to the heavy rains, while just the opposite condition obtained over a great part of Bengal. The disease this year was also specially fatal at the various military stations in Bombay, with the single exception of Ahmednagar; the admission-rate had increased, and in some instances the increase on that of the previous year was threefold. The civil population suffered in a corresponding degree. In Bombay, the year 1878 was marked by a total annual rainfall above the average, by a general deficiency of rain in January, February, and March, a general excess in April, a general deficiency in June, and a general excess for all the other months, excepting December. The temperature was under the normal. In the Central Provinces and Berar, when there was also an excess of rain, the fever deaths were nearly double the average. We may say that fever was epidemic throughout the whole of India in 1878, from the Himalayas to Cape Comorin, and from British Burma to the borders of Baluchistan, and under many diversities of temperature and rainfall. We do not have the means of tracing the epidemy beyond the limits of India for that year, but it will be remembered that 1878 and 1879 were years in which malaria was specially prevalent in Cyprus and the Levant generally.

That the scarcity, amounting in many districts to famine, augmented enormously the mortality among the natives of India in 1878, cannot be doubted; but the epidemy extended to districts untouched by the famine, and affected the troops who did not suffer want. This shows that the famine was an aggravating element, and not the essential cause of the outbreak.

The epidemy of 1879, the distribution of which we have traced, is only a continuation or recrudescence of that of 1878—striking with particular severity on the two Governments of the Punjab and North-West Provinces, but by no means limited to these. Epidemies of malarial fever, more frequently than otherwise, extend over two years. If the facts respecting the order in which the fever appeared in the different regions are correctly stated above, this epidemy did not conform to Bryden's theory of epidemic diffusion, for it does not appear to have extended from east to west, but to have appeared about the same time in Burma, Bengal, and Bombay, the last being that in which it first showed itself in force. The

epidemy was preceded by an exceptionally low mortality over a great part of the peninsula; a circumstance which is often noticed as precursory to fever epidemies.

Is this fever epidemy of 1878 and 1879 fully explained by any peculiarities of the weather during these years? I think not. In our ignorance of any evident cause for this extensive diffusion of malaria during these years, we must content ourselves with speaking of the real but unknown cause as an epidemic influence.

No very close relation can be traced between the rainfall of different years and the fever death-rate. In the Punjab, as a whole, the years 1880 and 1883 were years of low rainfall, and the fever deaths during those years were also below the average. The rainfall in 1884 was almost equal to that of 1885, but there was a great difference in the extent of the annual fever mortality in these years. Much more depends upon the distribution of the annual rainfall as regards the months and localities than upon the actual number of inches. The annual amount of fall and its distribution are not the sole factors in determining the death-rate from endemic fever, although the influence of the former on the endemic disease is much more marked than on the epidemic form.

Let us now see the average monthly distribution of fever admissions in the Punjab in relation to rainfall and temperature for the ten years 1870–79. The percentages are calculated upon 536 admissions from enteric fever, 76,981 admissions from intermittent fever, and 31,358 admissions from remittent and continued fevers :—

Months.	Monthly Percentage of Rainfall, 1870–79.	Monthly Percentages of Admissions from Fevers among European Troops, 1870–79.		
		Enteric Fever.	Intermittent Fever.	Remittent and Continued Fever.
January,	3·5	4·0	5·2	1·3
February,	5·3	4·0	3·6	1·4
March,	4·3	4·0	3·3	2·0
April,	3·0	8·0	3·9	6·1
May,	4·2	16·0	5·1	13·8
June,	9·7	18·0	5·7	12·3
July,	27·2	12·0	6·4	13·4
August,	25·0	8·0	8·1	13·1
September,	11·8	10·0	14·4	16·3
October,	1·8	8·0	19·2	12·6
November,	1·1	4·0	15·7	5·2
December,	3·1	4·0	9·4	2·5

Enteric fever in the Punjab will be seen to have pretty much the same seasonal incidence as the remittent and continued forms. In both a sudden rise in the admission-rate occurs in May, which in the Punjab is one of the very hot months, the temperature attaining its maximum in June, when enteric fever also attains its maximum. Remittent and continued fevers attain their maximum in September, when intermittent fevers commence to prevail; but apart from this September increase, the admission-rate for remittent and continued fevers remains nearly stationary from May to October, after which the admissions decrease, to attain their minimum in the cold season.

Intermittent fever has a distinct period of maximum intensity limited to September, October, and November. The increasing heat of May, June, and July scarcely affects them. They are essentially autumnal, beginning in the Punjab, not when the drying-up process is going on, as is often said, for in September this type of fever has become general, while a considerable fall of rain still continues, and when the humidity of the air has scarcely diminished from its maximum. At Mooltan in the west, and at Delhi on the east of the Punjab, the maximum humidity is attained in August. At Mooltan the maximum relative humidity is 64, and in September it is still 62. At Delhi the August maximum is 67, and it stands at 65 in September. If we allow a certain period of incubation for the fever, it may be doubtful whether the disease is not in many instances contracted in July and August, when the rains are at their height. Yet those who have studied the disease only as it presents itself in India, have not unnaturally come to regard the drying up of the rain as in some way a cause of the autumnal maximum. But we have only to cast our eye on the fever and rainfall curves of Rome to make us hesitate to subscribe to this doctrine. The maximum of admissions in the Punjab from intermittent fever certainly coincides with the drying up of the rains in October, and this may not be without an effect; but essentially the disease is not due to the drying-up process, as we shall presently see. In the meantime it must be remarked that there is one thing which distinguishes these autumnal fevers from the others. So far as I know, malarial fever never becomes truly epidemic in any other season than autumn. I do not remember coming across an instance of an epidemy of true malarial fever occurring in India during spring or summer, although it is no less important to observe, that in epidemic years the fever deaths begin to increase in the earlier part of the season.

We shall now inquire into the distribution of malarious diseases

in the different parts of the Punjab, and trace their connection with rainfall, irrigation, altitude, soil conditions, and temperature.

The Punjab was composed, until recently, of 10 divisions, comprising 32 districts, containing in 1881 nearly nineteen millions of inhabitants. We shall give the average fever death-rate for the ten years ending 1887 for each of these districts (that of Sirsa for seven years only). In order to give a general idea of the rainfall of these districts, I shall add the average annual rainfall.

It must be noticed that the registration is known to be defective in Pesháwar, Dera Ismail Khan, and Dera Gházi Khan; hence little reliance can be placed on the figures given for these districts.

	Fever Death-rate, 10 years.	Rainfall.		Fever Death-rate, 10 years.	Rainfall.
DELHI DIVISION.			LAHORE DIVISION.		
Delhi, . . .	32·68	37·3	Lahore, . .	20·86	20·8
Gurgaon, . .	32·42	29·8	Gujránwála, . .	19·08	22·2
Karnál, . . .	28·93	37·8	Ferozepore, . .	20·87	13·5
HISSAR DIVISION.			RÁWAL PINDI DIV.		
Hissár, . . .	20·48	20·7	Ráwal Pindi, .	22·92	34·1
Rohtak, . .	27·79	28·3	Jhelum, . .	18·59	24·6
Sirsa, . . .	18·06	14·8[1]	Gujrat, . . .	16·16	22·5
			Shahpur, . .	16·37	11·3
UMBALLA DIVISION.			MOOLTAN DIVISION.		
Umballa, . .	24·37	37·8	Mooltan, . .	19·83	5·8
Ludhiána, . .	23·77	29·9	Jhang, . . .	11·63	7·8
Simla, . . .	8·23	63·9	Montgomery, .	14·53	9·6
			Muzaffargarh, .	25·22	6·1
JULLUNDUR DIVISION.			DERAJAT DIVISION.		
Jullundur, . .	24·25	26·4	Dera Ismail Khan,	17·72	6·7
Hoshiárpur, . .	22·07	34·0	Dera Gházi Khan, .	14·37	6·8
Kángra, . .	17·12	96·5[2]	Bannu, . .	17·05	12·6
AMRITSAR DIVISION.			PESHÁWAR DIVISION.		
Amritsar, . .	21·79	20·6	Pesháwar, . .	12·60	13·8
Gurdáspur, . .	21·22	42·1	Hazára, . .	16·34	50·6[2]
Siálkot, . .	17·09	29·9	Kohát, . . .	13·34	16·8

The fever death-rates in this table are the means of two series of five years, viz. five years previous to 1883, and the five years 1883–87. The rainfalls are the average of four years, 1884–87.

It will be seen that the most feverish districts in the Punjab are those in the east, north-east, and central parts of the province. The western districts, with some exceptions, such as Muzaffargarh, are upon the whole more healthy.

[1] For 1884 only. [2] For 1885 only.

The prevalence of endemic fever in different districts seems to depend to a considerable extent upon one or more of the following conditions:—

(*a*) *General conditions*, such as the amount of rainfall, and the period of the year when the fall takes place; the manner of its distribution—whether equably in moderate showers over the rainy season, or unequally in torrential rains, submerging large tracts of country. The effect of the rainfall, whatever may be its amount or distribution, depends greatly upon the nature of the soil and subsoil, and upon the fact as to whether the ground is already surcharged with moisture, as happens in the irrigated areas. Temperature has also a certain influence. A high temperature appears to favour the prevalence of the remittent form of the disease.

(*b*) *Local conditions*, affecting the amount of water distributed to the soil, especially canal irrigation and river inundations. The extension of irrigation canals has materially raised the subsoil water level over large areas within the last thirty or forty years.

Local conditions, natural or artificial, facilitating or hindering the discharge of water and the drainage of the soil. On the one hand, we find some districts where the natural configuration of the country enables the heaviest floods to be harmlessly carried off, and others in which the level or hollow configuration of the country is a bar to the rapid discharge even of moderately heavy rains, which convert such localities into temporary swamps.

Artificial obstructions, caused by embankments, tend in numerous instances to obstruct the natural drainage, and cause waterlogging of the soil.

(*c*) *Altitude* has also a very perceptible influence upon the extent to which, and the season during which, fever prevails in different regions. That the distribution of malarial diseases in the Punjab, and its varying degree of prevalence in the different districts, is, to a considerable extent at least, determined by these causes, cannot admit of a doubt.

We shall first consider the local conditions to which fever is attributable in individual localities, and then inquire into its relation to rainfall and temperature.

Delhi stands in the first rank of fever-stricken districts. The drainage of this district "is quite inadequate to meet ordinary rainfall, and when the rainfall is excessive, all the evils arising from bad drainage are greatly aggravated" (*S. C. R.* 1887). This explains the marked difference in the health of wet and dry years in Delhi. In the dry year 1883 the fever death-rate in this district was 15·99; in the rainy year 1884 it was 36·54. A large area is

under irrigation, and, as a rule, the irrigated districts suffer most in fever years. The more elevated tracts, when well drained, are less malarious.[1] The evil effects of malaria attain their maximum in badly drained localities such as Balabgarh. Water, we are told, stands to a considerable depth in and about the town for some time after heavy rains. It is stated that during the rains of 1887 the town was like an island, the country around being flooded, and the inundation had caused many houses to fall. It is not to be wondered at that many of the inhabitants are reported to have died of fever, and that the survivors were sickly and anæmic, with enlarged spleens.

A proof that canal irrigation influences materially the prevalence of fever, is afforded by the statistics collected for some years of the death-rate in forty-eight villages situated along the West Jumna Canal in Delhi and Karnál. It was found that in these forty-eight villages the average fever death-rate for the five years 1879–83 was 36·6, while that of the province as a whole was 19·2.[2]

Gurgáon has nearly the same fever death-rate as Delhi, and the same conditions here exist—canal irrigation, large "jhils" or ponds, and deficient drainage.

In Karnál the localities that suffered most during the epidemy of 1884 were those in which natural drainage was deficient or obstructed. Dr. Stephen, in visiting, in 1886, the village of Námandah, in the south of the district, situated near the banks of the New Jumna Canal, two and a half years after the canal was opened, found every one suffering more or less from enlargement of the spleen, the result of malaria which was apparently intensified by the increased humidity of the soil caused by the canal.[3]

Rohtak is another district with a high fever death-rate; and, like Karnál, Delhi, and Gurgáon, it is one in which there is extensive canal irrigation. Respecting this region we learn that in 1886 the fever death-rate in the Gohána and Sámpla tahsíls was 26 per 1000; while in the Jhajjar and Rohtak tahsíls it was only 15 per 1000. It is added that in the Gohána and Sámpla there is much canal irrigation, and little in the Rohtak and Jhajjar tahsíls.

In Hissár, the Hánsi and Hissár divisions, which are under irrigation, and those parts of the country inundated by the overflow of the Ghaggar river, suffered most in 1887 (*S. C. R.* 1887). Umballa, Ludhiána, Jullundur, and Amritsar, although more healthy than the districts above mentioned, show, nevertheless, formidable

[1] "In the dry and mountainous parts of the district, where the wells are generally sunk in rock, and are less liable to surface infiltration, the epidemic prevailed with less severity."—*S. C. R.* 1884, p. 11.

[2] *S. M. I.* 1883, p. 180.

[3] *S. C. R.* 1886, p. 10.

fever death-rates; and in all of these regions it appears that fever is specially prevalent in the irrigated and inundated localities. In Jullundur the banks of the Sutlej, and in Ludhiána the districts along the Sutlej and Sirhind Canals, are notably malarious.

In 1881, the town of Amritsar, with a population of 136,166, suffered from a very fatal local epidemy of fever. The ratio of fever deaths in the town that year was 86·1 per 1000. In the suburbs, with 6449 inhabitants, the fever death-rate was only 6 per 1000, and that of the entire district 34·78 per 1000. It appears that 38 inches of rain fell in July and August, being 24 inches above the average for these two months. The town lies on a lower level than the surrounding country, so that the rain water formed large swamps—the water standing in some of the hollows for months. At the same time, too, a ditch surrounding the town was more or less filled with stagnant sewage. The soil of the town is saturated with filth, and the water supply is far from satisfactory. It is stated that during the epidemy not a single individual, native or European, in the town escaped. Most of the shops were closed, and business in the Government offices was carried on with the utmost difficulty; the fever was mostly intermittent and remittent, to which latter form most of the mortality was due. The intermittent was of the quotidian, tertian, and quartan types. Enlargement of the spleen occurred during the attacks, but subsided on an intermission taking place. The disease attained its maximum in October. No typhoid appearances were found after death. What was the reason that the suburbs of the town escaped? The excessive rainfall extended only a few miles on each side of the city, and the suburbs were better drained than the city. There can be little doubt that the cause of the outbreak was connected with the heavy rains swamping a town situated in a hollow, and otherwise in a bad sanitary condition; and it is rather remarkable that in such circumstances no typhoid lesions were observed. The epidemy was evidently one of malarial fever.

The Lahore division, as a whole, with the Lahore district, occupies a middle place between the highly malarious and the comparatively healthy parts of the province. In this district is situated Meean Meer, which has proved one of the most unhealthy cantonments in India. It had long been occupied by native troops before it was occupied by Europeans, and the soil is consequently assumed to be foul. The soil consists of mixed sand and clay, below which is a stratum of clay, which again rests upon a bed of laterite at an average depth of 12 feet from the surface. The upper layer is somewhat loose and porous, and has a capacity for holding

75 per cent. of water. It contains 41·3 per 1000 of organic matter, which Firth thinks is in excess of the scanty vegetation it supports. It also contains acid sulphates of iron and alumina, and chloride of sodium. Lime is deficient. The soil is dry and sterile. The configuration of the ground is unfavourable to complete and rapid drainage. The rainfall at Meean Meer is about 19 to 20 inches; in exceptionally rainy years, as 1881, it rises to 26 inches. The temperature is much higher than that of Lahore, if the figures given below are to be trusted. The well water is impregnated with saline matters, but a supply from the Ravi has been introduced. The monthly distribution of fever at Meean Meer differs little from that observed throughout the Punjab, as will be seen by the monthly averages of admissions given by Firth in a very full article upon the topography and climatology and the chemical changes going on in the soil of this locality, which will be found in the *Army Medical Report* for 1885.

AVERAGE MONTHLY FEVER ADMISSIONS AT MEAN MEER FOR TEN YEARS.

Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
110	130	80	90	150	120	140	220	260	333	160	120

Here we notice a distinct rise in the admissions in May, a marked fall in June, then a second rise, attaining its maximum in October.

The following are the chief results of Firth's observations, so far as I have been able to deduce them from his diagrams:—

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Mean temperature of air, 1885, . .	54°	60°	66°	76°	88°	92°	99°	99°	94°	82°	69°	60°
Rainfall, 1885, . .	1·2	0·4	0·0	0·7	0·6	2·45	7·4	3·0	3·3	0·25	0·0	0·0
Carbonic acid in soil air, 8 feet deep, volumes per 1000 volumes of air, .	5·0	4·0	3·5	7·0	8·0	8·5	9·0	11·0	10·5	9·5	6·0	5·0
Mean temperature of soil 6 feet deep, .	66°	68°	69°	70°	78°	84°	88°	89°	88°	84°	80°	70°
Difference of maximum and minimum of soil temperature at 3 feet deep, .	1·8	2·4	2·8	2·2	1·8	1·6	1·0	0·8	0·8	1·0	1·4	2·0
Fever admissions, 1885, . . .	40	22	22	30	53	60	53	78	98	180	80	50
Daily range of temperature, average of 5 years, . .	20·0	27·0	30·0	29·7	30·7	25·0	17·0	16·0	18·0	25·8	30·3	29·5

Firth concludes that the maximum soil temperature with minimum diurnal variations of the soil temperature, combined with increased moisture, are the real factors in determining the increase of carbonic acid in the soil air; that the amount of carbonic acid present in the soil has no direct relation in itself to malarial prevalence, but is an index of the chemical activity of the soil, the maximum of which is followed in a week or so by increased fever

prevalence. It is enough here to state these conclusions without entering into any discussion about the theories to which they may be supposed to point. Firth points out that the period of greatest fever prevalence does not coincide with that of the greatest daily range; a fact which, as he justly remarks, is opposed to the theory that malarial fever is simply the result of a chill.

Whatever the causes of the fever at Meean Meer may be, there is reason to believe that they are local. The fever is not entirely or chiefly due to general climatic conditions, nor is it at all probable that it is carried hither by the winds from any distance. In the year 1876 fever was very prevalent at this station, but it was observed that it affected very unequally the different corps in the cantonments. The general climatic conditions—temperature, vicissitudes of temperature, rainfall, atmospheric humidity—must have been identical throughout the cantonment; we must therefore ascribe the greater prevalence of fever in some of the corps to the immediate soil conditions surrounding their barracks, unless it was owing to some acquired predisposition or immunity of the men. The prevalence of fever on this bare plain serves to remind us, in the midst of our survey of the circumstances in which fever prevails in the Punjab, that extreme saturation of the soil from irrigation or inundation, however real its influence may be as a fever cause in the Punjab generally, is by no means an essential or necessary condition in India any more than in Italy for the generation of malaria. The soil conditions in Meean Meer remind us a good deal of those met with in the Roman Campagna.

In Ferozepore, in 1884, the fever death-rate was 33·30, which is very much above the average of this district. It is stated that "the portion of the district in which the people suffered most was Zira and Ferozepore, with a portion of the Muktsar tahsíl. This being the part of the district which has within the last few years been brought under canal irrigation, it would go to prove that dampness of the soil was a predisposing cause" (*S. C. R.* 1884).

The low fever mortality of Jhang, Shahpur, and Montgomery is explained by the light rainfall of these districts, and the small area irrigated by canals and flooded by rivers. But here, too, instances are numerous of local inundations being followed by increased prevalence of fever. Thus, Pind Dadan Khan, a town on the right bank of the Jhelum, north of Shahpur, suffered from an inundation in 1882 that covered the streets and lanes in some places to the depth of two feet. The consequence was that the mortality from fever that year was 40 per 1000.

Mooltan is much more severely affected with malaria than the

districts just mentioned, although it is within the same geographical region. This arises from its position in relation to the Chenab, the Ravi, and the Sutlej rivers, and the considerable extent of its irrigated area. It was remarked, in 1884, that fever prevailed principally along the banks of these rivers, and in the low grounds on the south-western side, where the Chenab and Sutlej join. There was scarcely a soul, we are told, in these parts that could boast of having escaped. The eastern portion, from which side the rivers flow, and the central plateau between, called "bar" or "Rava," almost entirely escaped from the ravages of fever (*S. C. R.* 1884).

Muzaffargarh, occupying the triangle formed by the junction of the Chenab and Indus, and liable to inundation from both, and which also contains in many parts large marshes or "dhands," is the most malarious district in the western part of the Punjab.

Simla, Kángra, and Hazára owe their comparatively low fever death-rates to their altitude.

Simla, at about 7000 feet above the sea-level, with an annual mean temperature of 61° F., and free drainage, is undoubtedly the least malarious district in the Punjab. The wonder is that at this height malaria should be met with at all. Let us examine the monthly distribution of fever deaths in this elevated locality. We shall here give the mean numbers of fever deaths for the four years 1884–87, and the average mean temperature of this locality:—

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Mean number of fever deaths,	22	16	22	27	34	44	24	37	41	40	29	22
Mean temperature,	40°	44°	53°	61°	66°	80°	75°	78°	70°	67°	52°	46°

It will be observed that fever here attains its maximum in June along with the maximum of temperature, falls in a marked way in July, then rises again until September and October, when a second, but here a minor, maximum occurs.

If we compare the monthly distribution of fever at Simla with that at Meean Meer, we observe that at the latter the autumnal rise is very much more marked. At Simla autumnal fevers are evidently comparatively rare. It is only in distinctly malarious years that the maximum of fever deaths occur in October. Such a year was 1884, when the monthly number of fever deaths and the rainfall were as follows:—

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Fever deaths,	23	22	34	35	49	65	32	64	67	72	53	38
Rainfall,	1·2	1·1	3·0	0·6	2·4	6·0	12·6	32·8	5·1	7·2	0·9	1·3

Here October is, as in the Punjab generally, the month of greatest fever mortality. This seems to point conclusively to the exist-

ence of malaria at Simla. We cannot help remarking that the fever deaths had already begun to exceed the average as early as March. This increase cannot be ascribed to excessive rainfall, for the season was very much drier than usual during the first six months, just as the latter part of the year was much wetter than usual. If we are to ascribe the high fever mortality during the autumn to the excessively heavy rains, to what are we to ascribe the unusually high fever mortality during the uncommonly dry weather in the earlier months? We may notice as a fact that dry and warm weather tends to increase the fever mortality in India during the earlier months, and that heavy rains tend to increase the fever mortality during autumn. Are we to explain the high fever mortality prevailing during both the wet and dry seasons of 1884 to climatic conditions, or to some epidemic influence that had begun to make itself felt in March? This question will be considered in the sequel.

Kángra, like Simla, owes its low fever death-rate to its altitude. Hazara, again, "is for the most part hilly; but portions of it, especially in the Haripur tahsíl, are comparatively level, with a wet subsoil." The fever death-rate of the entire district in 1887 was only 14·6, while that of the Haripur tahsíl was 17 per 1000.

There is good reason for believing that the Pesháwar statistics are defective as well as those of Dera Gházi Khan, Dera Ismail Khan, and Kohat. The military returns relating to Pesháwar prove beyond doubt that, at least, those localities in which the troops are stationed are highly malarious.

Monroe describes Pesháwar as an extensive valley, upwards of 2000 square miles in size, completely surrounded by lofty mountains, and traversed by three principal rivers, the Bara, the Kabul, and the Swat, the last two forming extensive marshes. The country north of Pesháwar is freely irrigated.

We have thus tried to illustrate, as far as our scope will permit, the causes affecting the geographical distribution of malaria in the Punjab—the configuration of the soil as regards facilities for drainage, the nature of the soil and subsoil, as illustrated by the instance of Meean Meer; the distribution of water to the soil, whether from rainfall, irrigation, or inundation; and the influence of altitude.

Before leaving this part of the subject, we shall take a glance at the prevalence of malarial fever among the troops in the various military circles of the Punjab for the years 1881–86 :—

PUNJAB.—MALARIAL FEVER.

	SIRHIND.		LAHORE.		RÁWAL PINDI.		PESHÁWAR.	
	Adm.	Died.	Adm.	Died.	Adm.	Died.	Adm.	Died.
1881, . . .	363·0	1·04	820·7	2·48	567·3	0·90	1272·5	0·00
1882, . . .	222·0	0·47	1201·0	0·87	440·1	0·84	1144·9	1·52
1883, . . .	152·1	0·68	647·6	0·00	390·4	0·59	800·3	0·00
1884, . . .	524·3	0·47	1413·4	1·11	282·0	1·03	741·6	0·00
1885, . . .	446·8	1·11	1091·6	0·67	182·7	...	428·1	1·22
1886, . . .	226·1	1·52	584·2	1·18	238·5	0·38	194·4	1·47
Means, . . .	322·4	0·88	959 7	1·05	350·1	0·62	763·6	0·70

SIRHIND.	LAHORE.	RÁWAL PINDI.	PESHÁWAR.
Umballa.	Mean Meer.	Ráwal Pindi.	Pesháwar.
Jullundur.	Fort Lahore.	Campbellpore.	Nowshera.
Subathu.	Amritsar.	Siálkot.	Cherat.
Dagshi.	Fort Govindgarh.	Dera Ismail Khan.	Hoti Murdan.
Jutogh.	Ferozepore.	Fort Attock.	
Solon.	Mooltan.	Khyra Gully.	
	Fort Kángra.		

From the above table it will be seen that Lahore is, both as regards admissions and deaths, the most malarious, as Ráwal Pindi is, as regards the death-rate, the most healthy of the Punjab circles.

We shall now see in what manner rainfall affects fever mortality. This subject has already been to some extent considered so far as the effects of annual rainfall are concerned.

The numerous circumstances modifying the influence of rainfall in particular localities have also been mentioned. These remarks have been confined to the influence of the amount of rain falling annually on the annual prevalence of fever, and have not dealt with the influence of the seasonal distribution of the rain on the monthly distribution of the fever mortality, a point which we shall presently consider. But before leaving this part of the subject, it may be well to bring the reality of the influence of the local rainfall of a district upon the fever mortality more distinctly into relief. We shall therefore reproduce the following table of the rainfall and fever mortality of four districts for a series of years. These are, as we have already pointed out, districts where canal irrigation is extensively carried out, and where there is a tendency to water-logging of the soil after heavy rainfalls :—

STATEMENT SHOWING THE RAINFALL IN INCHES REGISTERED IN THE THIRD QUARTER, AND THE NUMBER OF DEATHS FROM FEVERS REGISTERED IN THE FOURTH QUARTER, DURING THE YEARS 1881 TO 1887 INCLUSIVE, IN THE DISTRICTS OF DELHI, GURGÁON, ROHTAK, AND KARNÁL.

District.		1881.	1882.	1883.	1884.	1885.	1886.	1887.
Delhi,	Rainfall, . .	21	21	11	35	24[1]	17	30·7
	Fever mortality, .	5,612	3,143	2,878	13,519	11,828	5,460	14,638
Gurgáon,	Rainfall, . .	18	12	13	21	30	12	26·3
	Fever mortality, .	6,515	3,751	2,440	6,973	10,379	5,804	15,183
Rohtak,	Rainfall, . .	16	11	9	14	29	15	28·2
	Fever mortality, .	4,508	2,859	1,833	6,951	7,472	3,129	8,698
Karnál,	Rainfall, . .	15	16	12	33	20	18	41·9
	Fever mortality, .	4,771	3,225	2,486	14,975	6,470	4,670	9,698

Although the influence of rainfall in increasing the annual prevalence of fever is evident, it will be noticed that the fever deaths are not always in proportion to the rainfall, for 33 inches in Karnál, in 1884, gave rise to a much heavier mortality than did 41·9 inches in 1887. This much, however, may be said, that in this region years of small rainfall are years of low fever mortality, and *vice versa.*

The following tables will show the relation of the monthly distribution of rainfall to the monthly fever mortality for a series of years in Delhi, Rohtak, Umballa, Ferozepore, Amritsar, and Ludhiána:—

DELHI.

Months.	1883.		1884.		1885.		1886.		1887.		Means.	
	Fever Death-rate per 1000.	Rainfall.	Fever Death-rate per 1000.	Rainfall.	Fever Death-rate per 1000.	Rainfall.	Fever Death-rate per 1000.	Rainfall.	Fever Death-rate per 1000.	Rainfall.	Fever Death-rate per 1000.	Rainfall.
Jan., .	1·58	1·7	1·43	0·0	2·34	6·6	2·74	1·7	1·85	2·6	1·98	2·52
Feb., .	1·33	0·0	1·25	0·0	1·38	0·0	2·21	0·1	1·71	0·0	1·57	0·02
March, .	1·51	1·8	1·68	0·1	1·48	0·0	2·04	0·8	2·29	0·0	1·80	0·54
April, .	1·38	0·1	1·69	0·0	1·49	0·4	2·27	0·0	3·24	0·0	2·01	0·06
May, .	1·42	0·7	2·37	0·0	2·40	2·4	2·91	0·8	2·87	0·0	2·39	0·78
June, .	1·43	3·5	1·86	7·5	2·29	6·2	2·26	9·7	2·22	1·6	2·01	5·70
July, .	0·89	2·5	1·25	5·7	1·51	9·2	1·85	9·5	1·68	11·2	1·43	7·62
August, .	1·00	0·0	1·57	9·2	1·79	15·3	1·81	7·4	1·64	15·7	1·56	9·52
Sept., .	0·99	6·5	2·43	19·8	3·07	0·0	2·16	0·5	3·37	3·8	2·40	6·12
October, .	1·06	0·0	7·85	0·0	7·13	0·0	2·66	1·1	10·09	0·0	5·75	0·22
Nov., .	1·23	0·1	9·00	0·0	6·44	0·0	2·73	0·0	6·76	0·0	5·23	0·02
Dec., .	2·17	0·0	4·16	0·0	4·81	1·3	3·08	0·1	5·89	0·2	4·02	0·32
Total, .	15·99	16·8	36·54	42·3	36·13	41·4	28·72	31·7	43·61	35·1	32·19	33·46

[1] A fall of 6 inches was registered in June in addition to this.

Rohtak.

Months.	1883.		1884.		1885.		1886.		1887.		Means.	
	Fever Death-rate per 1000.	Rainfall.	Fever Death-rate per 1000.	Rainfall.	Fever Death-rate per 1000.	Rainfall.	Fever Death-rate per 1000.	Rainfall.	Fever Death-rate per 1000.	Rainfall.	Fever Death-rate per 1000.	Rainfall.
Jan., .	1·89		1·11	0·0	1·58	2·8	1·74	1·0	1·45	1·0	1·55	1·20
Feb., .	1·89		1·11	0·0	1·09	0·0	1·43	0·C	1·35	0·0	1·37	0·00
March, .	2·16		1·08	0·4	1·45	0·1	1·73	0·9	2·07	0·0	1·69	0·35
April, .	1·65		1·30	0·0	1·69	0·3	1·67	0·0	2·22	0·0	1·70	0·07
May, .	1·37		1·39	0·0	2·16	2·2	1·98	0·4	2·49	0·0	1·87	0·65
June, .	1·50		1·40	7·3	2·49	5·3	1·79	2·4	1·76	0·4	1·78	3·85
July, .	0·99		1·15	2·7	1·68	6·7	1·32	10·2	1·17	10·4	1·26	7·50
August, .	1·05		1·27	6·4	1·73	20·7	1·54	4·3	1·74	16·6	1·46	1·20
Sept., .	0·97		2·15	5·0	5·07	1·3	1·83	0·5	5·59	1·2	3·12	2·00
October, .	0·89		5·82	0·0	5·60	0·0	1·57	0·5	7·77	0·0	4·33	0·12
Nov., .	1·11		4·09	0·0	4·68	0·0	2·01	0·0	4·79	0·0	3·33	0·30
Dec., .	1·31		2·64	0·0	3·20	1·6	2·07	0·0	3·15	0·7	2·47	0·57
Total, .	16·80		24·51	21·8	32·42	41·0	20·68	20·2	35·55	30·3	25·99	28·32

Umballa.

Months.	1883.		1884.		1885.		1886.		1887.		Means.	
	Fever Death-rate per 1000.	Rainfall.	Fever Death-rate per 1000.	Rainfall.	Fever Death-rate per 1000.	Rainfall.	Fever Death-rate per 1000.	Rainfall.	Fever Death-rate per 1000.	Rainfall.	Fever Death-rate per 1000.	Rainfall.
Jan., .	1·39	2·2	0·91	0·1	2·31	3·1	1·58	2·6	1·78	1·7	1·59	1·94
Feb., .	1·37	0·0	0·89	0·0	1·50	0·0	1·56	0·1	1·58	0·0	1·38	0·02
March, .	1·59	0·3	1·09	0·0	1·26	0·0	1·43	1·9	1·89	0·0	1·45	0·44
April, .	1·09	0·0	1·14	0·0	1·31	0·0	1·37	0·0	2·06	0·0	1·39	0·00
May, .	1·19	1·4	1·35	0·0	1·65	1·8	1·71	1·4	2·30	0·0	1·64	0·92
June, .	1·56	1·2	1·31	2·1	1·49	8·8	1·56	4·6	2·28	2·8	1·44	3·90
July, .	1·16	6·2	1·13	15·3	1·24	5·2	1·25	15·0	1·64	9·8	1·28	10·30
August, .	1·21	0·8	1·93	13·5	1·29	11·2	1·36	6·5	1·35	11·3	1·42	8·66
Sept., .	1·20	5·0	7·11	12·4	2·09	0·4	2·23	1·9	3·13	12·9	3·15	6·52
October, .	1·21	0·0	15·12	1·9	2·92	0·0	2·87	0·8	4·54	0·0	5·33	6·54
Nov., .	1·19	1·9	8·31	0·0	2·31	0·0	2·51	0·0	3·44	0·0	3·45	0·38
Dec., .	1·34	0·1	4·83	0·0	2·10	2·0	2·40	0·1	2·57	0·4	2·64	0·52
Total, .	15·50	19·1	45·12	45·3	21·47	32·5	21·83	34·9	28·56	38·9	26·49	34·14

FEROZEPORE.

Months.	1883.		1884.		1885.		1886.		1887.		Means.	
	Fever Death-rate per 1000.	Rainfall.	Fever Death-rate per 1000.	Rainfall.	Fever Death-rate per 1000.	Rainfall.	Fever Death-rate per 1000.	Rainfall.	Fever Death-rate per 1000.	Rainfall.	Fever Death-rate per 1000.	Rainfall.
Jan., .	1·43	1·9	0·93	0·0	1·68	1·2	1·21	2·1	1·40	0·3	1·33	1·10
Feb., .	0·98	0·0	1·02	0·7	1·04	0·0	1·21	0.0	1·28	0·0	1·10	0·14
March, .	0·89	0·1	1·15	0·4	1·05	0·0	1·14	1·7	1·43	0·0	1·13	0·44
April, .	1·01	0·9	1·31	0·0	1·01	0·4	1·10	0·0	1·76	0·0	1·23	0·26
May, .	1·08	0·5	1·49	0·4	1·14	2·4	1·38	0·0	1·81	0·2	1·38	0·70
June, .	1·06	0·0	1·30	3·9	1·21	1·2	1·40	6·4	1·56	0·6	1·30	2·42
July, .	1·09	2·8	1·11	2·6	1·14	3·6	1·13	4·9	1·47	0·8	1·18	2·94
August, .	1·06	0·4	1·49	2·4	1·04	1·7	1·39	1·5	1·50	6·3	1·29	2·46
Sept., .	0·87	9·2	2·80	4·3	1·40	0·0	1·86	0·0	3·25	1·2	2·03	2·94
October, .	1·22	0·0	9·83	0·5	2·18	0·0	2·28	1·1	5·19	0·0	4·13	0·32
Nov., .	1·22	0·6	7·46	0·0	2·17	0·0	2·40	0·3	3·67	0·0	3·38	0·18
Dec., .	1·32	0·0	3·41	0·0	1·72	1·1	1·92	0·0	2·36	0·0	2·14	0·22
Total, .	13·24	16·4	33·30	15·2	16·78	11·6	18·42	18·0	26·68	9·4	21·68	14·12

AMRITSAR.

Months.	1883.		1884.		1885.		1886.		1887.		Means.	
	Fever Death-rate per 1000.	Rainfall.	Fever Death-rate per 1000.	Rainfall.	Fever Death-rate per 1000.	Rainfall.	Fever Death-rate per 1000.	Rainfall.	Fever Death-rate per 1000.	Rainfall.	Fever Death-rate per 1000.	Rainfall.
Jan., .	1·43	2·7	1·16	0·0	1·12	2·7	1·30	1·8	1·26	0·9	1·25	1·62
Feb., .	0·99	0·0	1·07	0·8	0·73	0·4	0·96	0·4	0·99	0·0	0·94	0·32
March, .	0·88	0·3	1·19	0·6	0·83	0·0	0·95	3·5	1·19	0·0	1·00	0·88
April, .	0·86	0·6	1·17	0·0	0·89	0·5	0·89	0·2	1·36	0·0	1·03	0·26
May, .	1·38	13·0	1·88	0·5	1·35	3·7	2·04	0·2	1·85	0·1	1·70	0·35
June, .	1·30	0·0	1·58	1·7	1·29	0·3	1·89	8·4	1·62	0·6	1·53	2·20
July, .	1·20	6·1	1·32	7·9	1·28	3·1	1·43	13·6	1·46	2·4	1·33	6·62
August, .	1·19	4·2	1·30	2·7	1·17	2·9	1·59	0·5	1·33	10·1	1·31	4·08
Sept., .	1·02	7·8	1·80	6·2	1·23	1·1	1·87	0·0	2·86	1·0	1·75	3·22
October, .	1·28	0·0	3·31	0·1	1·55	0·0	1·97	1·8	5·45	0·0	2·71	0·38
Nov., .	1·63	1·2	3·13	0·0	1·77	0·0	2·22	0·0	3·98	0·0	2·54	0·24
Dec., .	1·51	0·0	1·91	0·2	1·95	1·5	1·63	0·1	2·64	0·0	1·92	0·36
Total, .	14·67	24·2	20·82	20·7	15·16	16·2	18·74	30·5	25·99	15·1	19·07	21·34

LUDHIÁNA.

Months.	1883.		1884.		1885.		1886.		1886.		Means.	
	Fever Death-rate per 1000.	Rainfall.	Fever Death-rate per 1000.	Rainfall.	Fever Death-rate per 1000.	Rainfall.	Fever Death-rate per 1000.	Rainfall.	Fever Death-rate per 1000.	Rainfall.	Fever Death-rate per 1000.	Rainfall.
Jan., .	1·37	3·4	1·08	0·1	1·89	2·9	1·40	3·0	1·11	3·4	1·38	2·56
Feb., .	0·81	0·4	0·98	0·6	1·09	0·2	1·46	0·3	1·02	0·0	1·07	0·30
March, .	0·79	0·9	1·22	0·2	1·07	0·3	1·26	3·1	1·19	0·0	1·10	0·90
April, .	0·87	0·1	1·35	0·0	0·99	1·8	1·19	0·0	1·57	0·5	1·19	0·48
May, .	0·97	1·0	1·39	0·4	1·13	2·2	1·61	0·2	1·48	0·9	1·31	0·94
June, .	1·03	1·5	1·44	2·3	1·47	2·8	1·64	1·8	1·47	2·1	1·41	2·10
July, .	0·94	12·6	1·29	9·7	1·34	5·3	1·38	14·5	1·21	5·4	1·23	9·50
August, .	1·20	0·4	1·96	2·5	1·42	10·9	1·61	4·3	1·24	13·1	1·48	6·24
Sept., .	1·05	13·2	6·45	10·3	1·90	1·8	2·26	0·9	3·60	5·9	3·05	6·42
October, .	1·43	0·0	20·21	1·1	2·65	0·0	2·35	2·6	5·55	0·2	6·43	0·78
Nov., .	1·74	0·7	11·17	0·0	2·77	0·0	2·06	0·4	3·56	0·0	4·26	0·22
Dec., .	1·50	0·7	4·41	0·0	1·95	2·2	1·71	0·6	2·06	0·0	2·32	0·70
Total, .	13·70	34·9	52·95	27·2	19·77	30·4	19·93	31·7	25·11	31·5	26·29	31·14

Without analysing these tables in detail, I shall briefly state the result of my analysis of the Delhi table, and shall then point out a few particulars respecting the other districts, which it is of some importance to notice.

(*a*) Rains above the average during the first five months have little effect upon the fever deaths; it is doubtful whether they tend to diminish or to increase them.

(*b*) Heavy rains in June and July have little influence on the fever mortality, unless it may be that by their cumulative effect they increase the influence of rains in the autumn months.

(*c*) Heavy rains in August appear to raise the fever mortality in September, but especially in October (1885, 1887).

(*d*) Heavy rains in September are sometimes followed by a retardation of the maximum fever death-rate to November or December (1883, 1884). But these results are not of general application.

In Rohtak,* in 1885, a fall of 20·7 inches of rain in August was followed by a very considerable rise in the fever death-rate which appeared in September, attaining its maximum in October, and continuing high throughout the year. In 1887, a heavy rainfall in August was followed by the same progress in the fever deaths; only in that year a smaller rainfall was followed by a heavier mortality. Here we must assume that the operation of some other element gave greater effect to the smaller rainfall of 1887.

At Ferozepore, in 1883,—a non-epidemic year,—we see practically no result following from the fall of 9·2 inches of rain in September, while a fall of 4·3 inches in the same month, in the epidemic year 1884, was followed by a very high death-rate in October and November. In Ludhiána the total rainfall for the three months, July, August, and September, and the annual fever death-rates for 1883, 1884, and 1887, were as follows:—

	Rainfall of July, August, September.	Fever Death-rate per 1000.
1883, ...	26·2	13·70
1884, ...	22·5	52·95
1887, ...	24·4	25·11

It must be observed that in 1884, with a deficient rainfall, the fever, which was very fatal, had already begun to manifest some intensity during the earlier months of the year. Surely we have here evidence of the presence of some unknown factor, in one or other of these years, as an inhibiting or intensifying agent.

Speaking of the causes of the excess of fever in Simla in the year 1884, we asked the question, whether the great rise in the number of fever deaths at that station, from March onwards, was not the result of some epidemic influence. We think that these facts afford evidence sufficient to enable us to answer the question in the affirmative. Whatever name may be given to the cause of this variation in the fever deaths in certain years, some cause independent of rainfall does exist, imparting an epidemic character to the year, and modifying the influence of rainfall upon the evolution of fever. In the Punjab, the epidemic prevalence of fever in autumn is foreshadowed by, and may be anticipated from, an unusual prevalence of fever in the earlier months of the year.

I am unable to enter fully into the influence of temperature upon the prevalence and fatality of fever in the Punjab. I shall only mention that at Delhi, in 1884, the temperature of the first four months was above, and that of the last five months below the normal, while the fever death-rate was above the normal in both seasons. As such instances are numerous, there is reason to believe that a high temperature and a scanty rainfall tend to develope the early crop of fevers, while a low temperature and a heavy rainfall favour the autumn crop.

Fever in the Punjab is of the remittent and intermittent type, the former beginning to increase in April, and remaining at a pretty uniform figure until October; the latter being almost confined to the four months, August, September, October, and November. We obtain a few glimpses here and there from the official reports of the forms assumed by the fever in epidemic years. At Mooltan, in

1884, the symptoms, we are told, were those of ague, but its intensity was greater, and the duration of the accession longer than one day, —sometimes three or four days. It left the patient pale and exhausted for a few days, and then reappeared with similar force. Gradually, as the year approached its end, the fever assumed the milder tertian and quartan types, the quartan being the more common. About the middle of September the fever was accompanied by diarrhœa, dysentery, coryza, and sore throat, and in the latter part of November it was often complicated with pneumonia. This pseudo-continued form, with relapses, reminds us of the Cyprus epidemic, and of the endemic fever of Upper Tonkin. At Muzaffargarh, again, in 1884, jaundice was a very general complication, and after repeated attacks of fever, dysentery was apt to supervene; while in those weakened by the disease, bronchitis and pneumonia were observed to occur towards the end of the year, that is, during the cold weather.

CHAPTER IV.

ENDEMIC AND EPIDEMIC MALARIA IN THE NORTH-WEST PROVINCES AND OUDH.

MAKING every allowance for the frequency with which deaths due to other causes are ascribed to fever, and for the consequent exaggeration of the figures of fever mortality, the North-West Provinces must be acknowledged to be one of the most malarious regions of India. The following table gives the registered ratio of fever deaths per 1000 for the years 1874–86, and the annual rainfall, so far as I have ascertained it:—

	Years.	Fever Death-rate.	Rainfall.
Average of 5 years,	1874–78,	23·30	...
Average of	1879,	37·82	49·01
,,	1880,	23·11	28·23
,,	1881,	24·95	35·84
,,	1882,	24·90	33·01
,,	1883,	18·82	27·51
,,	1884,	24·35	42·78
,,	1885,	25·48	45·89
,,	1886,	27·58	heavy, exact amount unknown.

We shall briefly examine the fever history of some of those years, in order to see what light this casts upon the causes of fever in these Provinces, and in India generally.

We have already considered in some detail the general characters of the year 1879. In the North-West Provinces the fever mortality of 1879 was the highest of the series. Indeed, it was, out of all proportion, the most fatal fever year in these Provinces. The rainfall of 1879 was certainly very heavy in these Provinces, but it was not so much in excess of that of 1885 as to account for the great difference in the fever death-rates of the two years. It was probably little if at all heavier than that of 1886, while the fever mortality of 1879 was 10 per 1000 higher than that of 1886. This shows that the exceptional fever mortality of 1879 is not to be accounted for simply by the excessive rainfall. The year 1879 was a year of scarcity, but the year 1878 was worse in this respect than 1879. Yet the fever death-rate of the former year was only 22·9. We cannot, therefore, accept either the high annual rainfall, or the

scarcity of food in 1879, as an adequate explanation of the extreme insalubrity of this year. Let us see whether any explanation can be found in other circumstances.

The fever in 1879 affected every district in the North-West Provinces and Oudh, with the exception of the hilly countries of Kumaun and Garhwál. It was especialy fatal in the districts of Bulandshahr and Aligarh, where the annual death-rate from this cause alone rose to 113·70 and 113·56 per 1000 respectively. The fever death-rate exceeded 50 per 1000 in Meerut, Etah, Muttra, Mainpuri, Budaun, Muzaffarnagar, Hardoi, Farukhabad, and Agra. These districts occupy a compact geographical area, comprising the Doab from Sahāranpur on the north to Cawnpore in the south, and the contiguous districts of Budaun and Hardoi on the east side of the Ganges. The eastern part of the United Provinces, comprising Rohilkhand (excepting Budaun), Oudh (excepting Hardoi), Allahabad, and Benares, escaped comparatively lightly. All the worst affected districts mentioned above are canal-irrigated, with the exception of Budaun and Hardoi. If these two localities had escaped, the inference would have been irresistible, that conditions of soil peculiar to canal-irrigated localities in rainy years were the chief or sole cause of the destructive epidemy of 1879. These conditions are stagnation of water in the soil, and a rise in the level of the subsoil water. But if these were the sole causes of this outbreak, how are we to explain the severity with which the disease fell on the two non-irrigated districts. The assumption that water-logging existed in Budaun and Hardoi as in the irrigated districts, and did not exist at all, or not to such an extent, in the localities that escaped, finds no support in the meteorology of that year. Budaun had an excess of rainfall of 13·88 inches; but Bareilly, which is amongst the less affected districts, had an excess of 38·15 inches. As for Hardoi, the excess was only 4·54 inches; while the neighbouring district of Sitapur, where the fever was by no means very fatal, had an excess of 22·91 inches.

Unless, therefore, there are some exceptional circumstances about the drainage of Budaun and Hardoi of which we are ignorant, there is no reason to suppose that they were more water-logged than were the rest of the non-irrigated districts to the east that were not fever-stricken. As a matter of fact, they had a much less rainfall than other parts that suffered less from fever. Whatever may have been the reason why these two non-irrigated districts were so severely visited, it is abundantly evident that fever did not prevail in particular localities at all in proportion to their rainfall. The rainfall was less in the fever-stricken districts of Bulandshahr,

Aligarh, Agra, and Meerut, than in the less affected districts of Bijnor, Bareilly, Sitapur, Benares, and Allahabad.

An explanation of the extreme prevalence of malaria in the particular area of the North-West Provinces which we have defined, has been sought, not in the total amount, but in the manner in which the rain was distributed in the various months. It is stated that in those districts where fever was so exceptionally prevalent the rainfall ceased about the 9th or 10th of September, and no more rain of any account fell there during the later months. This was particularly the case in the Meerut division, which was the worst fever centre. In the other and less severely afflicted districts, rain began to fall again between the 20th and 25th of September, and lasted until the end of the first week of October. According to this view, the heavy rains in July and August, followed by a deficiency of rain in September, favoured the development of the fever in the worst treated districts; while the continuance of the rains in September and the beginning of October in the less severely affected places delayed the outbreak of the fever until the setting in of the cold season checked its further progress.

In order to be better able to judge of the sufficiency of this explanation, I subjoin a table giving the monthly mortality in four severely and four mildly affected districts, with the rainfall of the same. I have added the monthly mean temperature and daily range of the districts for which they have been obtained.

FOUR MILDLY AFFECTED DISTRICTS.

	Benares.				Bareilly.				Sitapur.		Bijnor.	
Months.	Total Deaths.	Rainfall.	Mean Temperature.	Daily Range.	Total Deaths.	Rainfall.	Mean Temperature.	Daily Range.	Total Deaths.	Rainfall.	Total Deaths.	Rainfall.
Jan.,	1277	0·00	63·4	32·0	2115	0·02	60·1	28·8	1144	0·00	945	0·10
Feb.,	1156	0·45	69·2	29·4	1475	0·39	65·1	27·0	1073	0·00	862	1·60
Mar.,	1488	0·00	79·0	32·0	1282	0·76	73·8	26·4	1272	0·00	943	1·10
April,	1475	0·00	90·9	35·2	1524	0·00	87·6	33·2	1423	0·00	1665	0·10
May,	1802	0·01	96·3	28·6	1894	0·00	94·8	29·5	1589	0·80	1447	0·00
June,	1388	6·04	92·0	19·1	1556	3·69	89·8	19·6	1203	8·50	688	2·70
July,	1309	13·49	83·7	11·2	1294	34·61	82·9	9·3	983	24·50	703	13·00
Aug.,	1946	13·20	83·4	10·9	1861	28·75	82·0	9·0	1397	15·10	1094	18·40
Sept.,	1865	13·26	82·3	11·9	2371	8·37	83·2	13·5	1466	4·60	1426	3·20
Oct.,	2814	4·64	78·3	18·7	12,678	2·58	76·8	20·1	8518	10·60	8007	0·20
Nov.,	2945	0·00	66·9	27·8	9784	0·00	64·2	28·8	8388	0·00	6054	0·00
Dec.,	2076	0·00	59·7	28·2	7982	0·41	56·9	26·9	4653	0·20	3261	0·80
	21,541	51·09	78·08	23·8	45,816	79·58	76·4	22·7	33,109	64·30	27,095	41·20

FOUR SEVERELY AFFECTED DISTRICTS.

	Agra.				Meerut.				Bulandshahr.		Aligarh.	
Months.	Total Deaths.	Rainfall.	Mean Temperature.	Daily Range.	Total Deaths.	Rainfall.	Mean Temperature.	Daily Range.	Total Deaths.	Rainfall.	Total Deaths.	Rainfall.
Jan.,	2747	0·66	63·2	27·5	2936	0·56	59·7	31·8	1562	0·10	1738	0·20
Feb.,	1762	0·11	68·9	26·0	2230	1·32	65·0	29·0	1271	0·60	1452	0·00
Mar.,	1515	0·15	78·6	27·2	2424	0·75	74·1	28·0	1211	0·10	1387	0·20
April,	2227	0·03	92·6	30·4	2963	0·30	87·2	32·0	1451	0·00	1368	0·00
May,	2757	0·00	99·9	26·7	4195	0·05	94·7	29·1	2591	0·00	2229	0·00
June,	2053	3·02	93·9	18·7	3188	1·87	91·3	18·9	2690	3·10	2452	5·80
July,	1680	7·93	87·3	11·7	2690	12·49	85·9	11·7	1736	18·60	1716	14·80
Aug.,	8154	10·62	84·2	8·6	8473	13·81	83·4	9·3	6388	14·40	10,778	11·30
Sept.,	13,623	6·60	84·1	14·2	20,386	3·10	83·2	16·9	15,537	7·00	23,861	2·40
Oct.,	18,211	0·28	79·8	23·2	29,416	0·40	77·1	25·8	36,263	2·20	40,583	1·20
Nov.,	10,340	0·00	69·3	30·5	18,568	0·00	64·1	35·3	24,727	0·00	25,772	0·00
Dec.,	6370	0·20	61·7	29·4	12,282	0·92	57·1	31·7	13,933	1·50	13,830	0·60
	71,439	29·60	80·3	22·8	109,751	35·57	76·9	24·9	109,360	47·60	127,166	36·50

It will be observed that in the fever districts *par excellence* the epidemic had made headway before the period when it could have been affected in one way or another by the weather prevailing in the end of September and October. In all the worst fever centres it had begun to show unmistakeable signs of its virulence as early as August. This is sufficient to prove that the epidemic was due to other causes than the distribution of the September and October rains. The tables appear, indeed, to show that as early as May the epidemy had declared itself in some of the districts.

While we are upon the question of the influence of rainfall in the development of this epidemic, and having observed that the epidemic had begun in force as early as August, let us see whether there was any such great excess of rainfall in July and August in the worst affected centres as would, either by itself or as an addition to an irrigated area, account for the outbreak. The meteorological reports do not give the data necessary for comparing the monthly rainfall of 1879 with the average for all the districts noticed in the above table. But we find that at Agra there had been a deficiency of 1·22 inches in July, and an excess of 4·13 in August. At Etáwah, another affected district, the rainfall in July was 1·25 inches in excess; and in August and September there was an excess of only 0·50 of an inch. Yet these, as well as others, with a heavy July and August rainfall, experienced a marked increase of mortality in August which cannot be explained in every instance by any great rainfall in July and August. We are thus compelled to conclude

that the intensity and distribution of this epidemic are not explained by the excess of the rainfall that year, by its monthly distribution, by the scarcity of food, or by the water-logging of the soil. All these may have had a certain influence upon its intensity or localisation, but, separately or together, they do not fully account for either. We have to recognise here again the presence of an unknown influence. We have to do with true epidemic malarial fever, and such epidemies are comparatively little influenced by known meteorological conditions. They show a marked preference to water-logged localities, and yet they often extend, with great intensity, to others that are dry. We are not to conclude from this that endemic fever is as little influenced by the character of the weather. Epidemic and endemic malarial fever are governed each by its own laws.

In 1883 the rainfall was very scanty, and the fever deaths were correspondingly few. In what may be called fever years, the maximum of fever deaths in these Provinces occur in October, but in 1883 the maximum occurred in December. We shall give the percentage of fever deaths for the entire Province in 1883 and 1886, as illustrating the monthly incidence of fever in a healthy and an unhealthy year in the North-West Provinces:—

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Healthy year, 1883, .	8·9	7·6	8·1	8·6	8·7	8·5	7·5	7·9	7·6	8·1	8·9	9·3
Unhealthy year, 1886,	7·4	6·0	6·1	7·3	8·0	7·1	6·8	8·5	10·2	11·4	11·2	9·6

The spring rise in both years attains its maximum in May. The second rise is well marked in September in the unhealthy year, while this month was one of the healthiest in 1883. This anticipation of the second and true maximum of the fever curve is highly characteristic of fever years. Even in healthy years the fever mortality, in any district that may happen to be more severely affected, tends to attain its maximum at an earlier date than in those less severely affected. Thus, while in the North-West Provinces fever, in 1883, attained its maximum in December, yet if we take some of the more unhealthy districts during that year, such as Sahâranpur, Muzaffarnagar, and Farukhabad, the highest fever mortality was not in December, but in November. In epidemic years the rise, as we have seen, begins in August, or even earlier.

In 1883 every district in the North-West Provinces and Oudh except the Tarái had a fever death-rate below the average. In the midst of this general salubrity, the small town of Chibrámau, in the Farukhabad district, had a fever mortality of 71·3 per 1000. The

fever deaths numbered 570 in a population of 7990, and of those deaths 60 per cent. occurred in the last four months, and no fewer than 135, or about one-fourth, happened in October.[1] Here, where the fever assumed an epidemic character, the maximum, as usual, occurred in October, although that year, being a healthy one, the maximum in the North-West Provinces generally was in December, and in a few of the more feverish districts in November. As respects the cause of this outbreak, we are told that the rainfall at Chibrámau had not been deficient, as was the case in the Province generally—25·6 inches having fallen from June to September, which, although about the average, was more than double what fell at many other places. There were heavy falls between the 3rd and 20th August, and again on the 13th September. These rainfalls are said to have caused flooding of a considerable part of the town for many days together. "The town and its neighbourhood contains numerous pits, which are receptacles of refuse during the dry season, and of water during the rainy months." Again, at Barwala the people were found to be sickly and suffering from fever; while at Basauli, a village about a mile distant, the people were healthy. The cause was ascribed to the number of excavations surrounding Barwala containing filthy water. This is a good example of a local outbreak in a generally healthy year due to local conditions.

The year 1884 was a year of excessive autumnal rainfall, and marked especially by heavy rains in the first week of October, which, we are told, resulted "in much persistent flooding of the precincts or even the inhabited sites of centres of population. Late heavy rainfall of that character is followed in all years by a record of excessive fever mortality, and so it was in 1884" (*S. C. R.* 1884). This statement is equally difficult to support by facts, as that which ascribed the fever of 1879 to defect in the rainfall of the later months of that year. This will be seen by comparing the fever mortality and rainfall of 1884 with those of 1885. In this year (1884), omitting the Terái, the division most affected was Meerut, and the district in Meerut which suffered most was Sahåranpur, where the fever mortality was 48·28, as against a five-yearly average of 29·69. In the Meerut division the September rains were 10·2 inches in excess of the average. In Agra they were 6 inches in excess. The rainfall, we are told, was fairly distributed in time, and there were no long breaks. The rainfall in October was also in excess in all the divisions. We observe also that Sahåranpur district had a total rainfall of 48·52 inches that

[1] *S. C. R.* 1883, p. 10A.

year, against an average of 34·79. In fact, it appears to have been at once the most rainy and the most feverish locality in the North-West Provinces in 1884.

The year 1885 was remarkable for its heavy June, July, and August rainfall, and for a deficient fall in September and October. There was great flooding of the Bulandshahr district in July, and many districts were inundated during August. The distribution of the rainfall was thus very different from that of the preceding year, when September and October were rainy. The total annual rainfall for 1885 was about 3 inches higher than that of 1884. The fever death-rate was also higher, although it was confined more exclusively to water-logged localities in 1885 than in 1884, when malaria was prevalent over a great part of India.

To see what effect this different distribution of the rainfall had in modifying the monthly incidence of the fever mortality, let us compare the two districts which had the heaviest fever mortality in 1884 and 1885; these were Saháranpur and Bulándshahr.

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Percentage of Fever Deaths at Saháranpur Rainfall being above the average in August, September, and October 1884.	4·0	3·8	4·9	5·4	6·0	5·0	3·7	6·0	12·2	22·3	16·1	10·3
Percentage of Fever Deaths at Bulandshahr. Rainfall being above the average in August, below average in September and October 1885.	4·3	2·8	3·3	3·2	3·9	4·4	3·3	4·3	10·5	24·2	22·1	13·6

It does not appear from these figures that the different distribution of the rainfall goes far in explaining the different monthly distribution of the fever mortality.

The rise of the fever mortality in April, May, and June of 1884 was only what is usually seen in epidemic years. The autumn rise appeared earlier and was less abrupt in 1884 than in 1885. The only peculiarity in the table that can be ascribed to the heavy summer rains followed by dry weather in 1885, is the higher rise of the curve in October and November.

The geographical distribution of malaria in these Provinces will be understood from the following table:—

DISTRIBUTION OF FEVER IN THE NORTH-WEST PROVINCES AND OUDH (DEATH-RATES PER 1000).

	Average of 5 Years 1878–82.	1883.	1884.	1885.	1886.
Hill Stations, Kumaun, ...	11·52	10·58	13·19	11·78	12·56
Hill Stations, Garhwál, ...	10·07	10·65	10·77	11·86	11·09
Hill Stations, Dehra Dun, ...	12·58	12·53	13·99	13·21	12·38
The Tarái, ...	39·57	41·61	45·47	34·79	47·99
Rohilkhand (not irrigated), 6 Districts, . .	28·25	18·18	28·79	32·91	41·56
Sitapur (not irrigated), 3 Districts, . . .	25·20	17·37	24·10	22·93	26·47
Meerut (irrigated), 5 Districts, excluding Dehra Dun, ...	38·29	22·86	39·54	40·63	34·09
Agra (irrigated), 6 Districts, ...	34·62	21·50	31·98	31·13	27·71
Lucknow (not irrigated), 3 Districts, . .	24·97	17·81	20·85	24·14	27·50
Allahabad (not irrigated), 5 Districts, excluding Cawnpore, ...	22·08	19·93	21·21	18·8	22·76
Cawnpore (irrigated), ...	34·52	27·38	34·37	30·14	27·09
Rae Bareli (not irrigated), 3 Districts, . .	22·83	19·94	17·01	20·80	24·00
Fyzabad (not irrigated), 3 Districts, . .	21·35	18·94	17·38	20·43	25·03
Benares (not irrigated), 7 Districts, . . .	22·69	16·25	17·99	19·63	22·98
Jhánsi (not irrigated), 2 Districts, omitting Lalitpur, ...	24·10	16·41	26·18	20·45	26·65
Lalitpur (not irrigated), ...	10·92	6·57	7·99	7·75	10·45

The comparative healthiness of the hill stations and the excessive unhealthiness of the Tarái require no explanation. The most interesting point regarding the Tarái is the immunity from fever enjoyed by the aboriginal inhabitants, named the *Tarus* (*S. M. I.* 1882).

The following is the monthly incidence of fever in the Kumaun and Tarái districts, the one in the hills, the other at their base:—

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Kumaun, . . .	7·35	6·81	5·75	7·82	10·43	12·6	10·80	9·09	7·07	7·60	7·49	7·14
Tarái, ...	8·92	6·91	6·57	7·32	8·57	9·60	5·70	5·38	6·12	10·70	13·79	10·39

The autumnal rise in the fever death-rate in the excessively malarious Tarái presents a striking contrast to the summer rise in Kumaun.

Lalitpur, in the Jhánsi division, is also a non-malarious locality. In the other districts the most important factor in determining fever prevalence appears to be canal irrigation. The canal irrigated districts are:—

Saháranpur.	Bulandshahr.	Farukhabad.	Cawnpore.
Muzaffarnagar.	Aligarh.	Mainpuri.	Muttra.
Meerut.	Etah.	Etáwah.	Agra.

The following are the ratios of fever deaths for these districts and for the entire Province:—

North-West Provinces and Oudh — Ratio of Fever Deaths in Twelve Irrigated Areas and for the Province, 1878–1884.

Years.	Fever Deaths per 1000.	
	12 Irrigated Districts.	Corresponding Provincial Rates.
1878, ...	29·1	22·9
1879, ...	67·9	37·8
1880, ...	28·0	23·1
1881, ...	26·5	24·9
1882, ...	26·3	24·9
1883, ...	22·5	18·8
1884, ...	35·33	24·35
Aggregate, . .	235·63	176·75

It is scarcely possible to misinterpret these figures. In the North-West Provinces it is not a question of the amount of rainfall so much as the facilities for drainage. Sweeney has pointed out that when obstruction to drainage raises the water-level to within six or eight feet of the surface in the Doab, the fever death-rate is immense; but if it never reaches at any time this point, its height is immaterial as respects its influence on fevers. "In years of ordinary rainfall the artificial substitutes for obstructed natural drainage are nearly, if not quite, sufficient; but when the rainfall is heavy, obstruction ensues, and in almost direct proportion to it will be found the fever death-rate. In the non-irrigated districts, the direct proportion between the fever deaths and the excess of rainfall is not observed, even although the rainfall in the non-irrigated is greater than in the irrigated districts;" from which he draws the conclusion that, "where natural drainage exists, rainfall is harmless; but rainfall, where surface drainage is obstructed, becomes a fertile source of death" (*S. C. R.* 1885).

This conclusion respecting the influence of rainfall on the prevalence of endemic, as distinguished from epidemic, fever is supported by the observations of Dr. Richardson, to be found in the report quoted above. "Where fever," he says, "had stricken down the majority of the inhabitants of a town or village, inquiry invariably showed defective drainage to exist or flooding to have taken place. Where fever prevailed to a slight extent, the natural configuration of the inhabited site permitted the storm water to escape quickly, or cuttings had been made which effected the same result."

Notter, in writing of Meerut, says, "Malarious fever has increased since 1870. It has more than doubled among the

European soldiers, trebled among the native troops, and quadrupled in the Central Prison. The subsoil water has been gradually rising since 1869. At the close of the rains in that year it was 14 feet 2 inches below the surface; on the 30th September 1885 it was 8 feet 11 inches."

He remarks that the presence of excess of moisture in the soil is due in part to the obstruction to the natural drainage by the canals as well as to the railway (*Army Medical Report*, 1880).

The evil effect of water-logging of the soil, whether brought about through irrigation, or inundation, or by excess of rainfall, is a point past dispute. It must be counted as a potent factor in increasing malarial prevalence. Endemic malaria in such circumstances seems to vindicate its title to the name of marsh fever, for all these conditions bring about a marshy state of the soil; doubtless there are localities in the North-West Provinces which, like Meean Meer, are malarious without being marshy; but of these I know nothing.

The following table gives the distribution of paroxysmal fevers in the military circles of the North-West Provinces and Oudh from 1881 to 1886:[1]—

Malarial Fever.

	Allahabad.		Oudh.		Rohilkhand.		Meerut.	
	Adm.	Died.	Adm.	Died.	Adm.	Died.	Adm.	Died.
1881,	433·8	0·84	248·8	0·00	312·9	1·08	711·7	1·13
1882,	318·3	2·32	457·0	0·00	1398·3	0·61	599·4	0·20
1883,	187·8	0·97	176·2	0·00	518·7	1·83	412·4	0·22
1884,	301·4	0·00	114·2	0·00	136·4	0·00	957·8	0·00
1885,	240·9	0·98	221·6	0·28	347·6	0·00	1263·3	0·62
1886,	398·6	1·22	110·6	0·30	279·0	0·00	666·0	0·55
Means,	313·4	1·05	221·4	0·09	498·8	0·59	786·4	0·45

Allahabad.	Oudh.	Rohilkhand.	Meerut.
Allahabad.	Lucknow.	Bareilly.	Meerut.
Fort Allahabad.	Fyzabad.	Shahjehanpur.	Fatehgarh.
Dinapore.	Sitapur.	Moradabad.	Agra.
Benares.		Ranikhet.	Muttra.
Chunar.		Choubatia.	Delhi.
Cawnpore.			Roorkee.
			Chakrata.

[1] The comparatively small numbers on which the death-rates are calculated is a fact to be borne in mind, especially in drawing inferences from the results of one or two years.

Oudh has the lowest ratio of fever admissions, and also the lowest fever death-rate. Allahabad, which ranks next in respect to the number of admissions, has (perhaps from exceptional or local causes) the highest fever death-rate; the prevalence of fever at Meerut among the troops is out of proportion to its fatality. Dysentery is most prevalent and fatal at Allahabad, and Meerut takes the second place. While Oudh, with a low fever death-rate, has also the lowest death-rate for dysentery. This warns us, notwithstanding numerous instances in point, not to conclude that fever prevalence and fatality necessarily bear an inverse relation to dysentery prevalence and fatality.

Notter states that purpura, closely resembling scurvy, occurs at Meerut, where vegetables are abundant. He thinks it is the effect of a hepatic germ of the malarial type! In other words, that it is in some way related to malaria. This deserves to be remembered in connection with the Cyprus epidemic, where a species of purpura was one of the leading symptoms.

The same author also notices the occurrence at Meerut of an intermittent hæmatoglobinuria, the urine being one day clear, of normal specific gravity, containing no albumen, and depositing no lithates; the next day of a chocolate brown colour, of high specific gravity, containing albumen and sugar, and depositing lithates. (*Army Medical Report*, 1885, p. 37.)

CHAPTER V.

ENDEMIC AND EPIDEMIC MALARIA IN BENGAL.

THE registration in this Province was so defective during the decade 1870–79, that it would only be misleading to make use of the earlier ratios given in the official returns. The later years show an improvement in this respect, but it is certain that the ratio of fever deaths is still considerably understated. The mean fever death-rate of the civil population during the four years 1881–84 was 14·54 per 1000. This, no doubt, is a high fever death-rate, but it is trifling compared to that returned from the North-West Provinces or the Punjab. There are, however, districts in Bengal where malarial fevers attain a high degree of prevalence and intensity. The most unhealthy, that is, most feverish, regions in Bengal are:—Rajshahye, Dinagepore, Jalpaiguri, Maldah, Rungpore, Bogra, Pubna, Murshedabad. Gregg believes that the region comprised in the great triangle lying between Gunduck and the Ganges on the south, the Berhampooter (Brahmapootra) on the east, and the Himalayas on the north, will be found to be that specially affected by severe malarious fever (*S. C. R.* 1877), Beerbhoom, Bankoora, Burdwan, Jessore, Hugli, the 24 Pergunnahs, and Midnapore, Hazaribagh, in the west, and Darjiling, in the north, have also high fever death-rates.

In almost every locality fever is most severe in the water-logged jungly districts, and in villages where the drinking-water is bad, and where foul tanks, interments in house compounds, and similar insanitary conditions prevail.

The localities that suffer least are those where the country is free from jungle, the soil porous, the drainage good, and the general sanitary conditions fair. This is only a general statement, but it is supported by the concurrent evidence of all observers.

The annual variations in the prevalence of malarial diseases in Lower Bengal may be roughly estimated by the annual fluctuations in the admission and death-rates among the European troops stationed in the Presidency circle, which includes the stations of

Calcutta, Barrackpore, Dum-Dum, Darjiling, and, for a part of the period, the station of Hazaribagh.

Year.	Admission.	Death-rate.
1877, ...	254·40	0·00
1878, ...	439·06	0·97
1879, ...	279·80	1·40
1880, ...	532·50	3·51
1881, ...	565·50	1·04
1882, ...	248·70	0·47
1883, ...	130·40	0·00
1884, ...	179·10	0·00
1885, ...	288·40	1·03

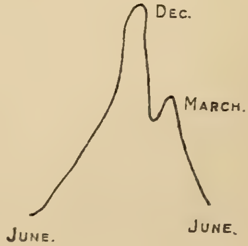
The monthly distribution of fever deaths in Bengal, with reference to rainfall and temperature, will be gathered from the following table, which gives the monthly percentage of 819,297 fever deaths occurring from 1879 to 1883, and the average monthly rainfall and temperature of the Province:[1]—

MONTHLY PERCENTAGE OF FEVER DEATHS IN BENGAL, 1879–1883, AND AVERAGE RAINFALL AND TEMPERATURE.

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Monthly percentage of Fever Deaths, . .	8·9	7·0	7·1	7·3	6·7	6·0	6·8	7·7	8·1	9·8	12·1	12·2
Average Rainfall. . .	0·54	0·94	1·24	2·33	5·14	12·14	13·94	13·09	10·53	4·63	0·48	0·16
Average Temperature, .	63·5	64·2	76·3	76·4	83·5	83·1	81·3	81·2	81·2	78·4	71·4	64·0

A slight rise in the number of fever deaths takes place in March and April. In May, June, and July, which are the warmest months, the minimum fever mortality is attained, the actual minimum occurring in June, coincident with the commencement of the heavy rains and a temperature only a few decimals below the maximum. August, September, and October are marked by a gradual increase in the fever death-rate, which attains its maximum in November and December, which are cold and dry months. In January a considerable reduction in the number of deaths takes place, which continues during February, when the slight spring-rise begins.

The annual course of the fever for Lower Bengal mortality is thus graphically depicted by Gregg:—



The monthly admission-rates per 1000 for intermittent and for remittent and continued fevers amongst the European troops in Bengal proper, for the ten years 1870–79, as given by Bryden, show that the period of the maximum prevalence of intermittent fever extends in this region from October to December, and that of remittent and continued fevers from June to August:—

[1] The averages of temperature and rainfall which refer to the Province are deduced from a table on Sanitary Measures in India, 1881–82.

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Intermittent Fever, .	19·6	9·7	7·7	9·6	9·4	9·8	12·2	14·5	12·6	13·7	26·3	30·6
Remittent and Continued Fever, . . .	7·9	7·7	10·6	15·3	18·8	27·4	31·4	33·2	22·8	22·5	23·6	12·1

By comparing these figures with the chart already given of the monthly distribution of fever admissions among the native troops at Barrackpore, they will be seen to differ chiefly in the absence of the spring rise in April,—so marked in that chart,—and in the autumn maximum being attained in October instead of December. In both armies the remittent and continued forms are most common in the hot season. It is probable that the period of malarial prevalence varies somewhat in different localities in the Province. Of 4644 cases of malarial fever observed by Wise at Chittagong,[1] 1634 occurred in May, June, and July, and 1119 only in the months of October, November, and December. Perhaps these may have been observed during an exceptional season. The district is said to be one where numerous canals and creeks render the locality very malarious. In Darjiling the maximum of fever deaths occur in May, and in the hilly Hazaribagh district there is a great rise in the death-rate in April.

The upper delta of the Ganges is distinguished from other parts of India by the outbreak of local epidemics of fever of a very fatal character, shifting their centres from time to time, and spreading from such centres circumferentially in a progressive way from year to year. Our information respecting the history of these outbreaks is imperfect; but a few general facts are known referring to epidemics that have been observed during this century. Thus we hear of a fever, called by the natives "jur beekar," as prevailing in an epidemic form at Mahomedpore, on the river Ellen Kallee, in Jessore, in 1824 and 1825, from which it spread to Dalga and Nuldanga, reaching Chashra in 1831, passing into Nuddea about 1832, attacking successively Gudkhally, Goatallee, Khandbeela, and Sookpokooria, and returning upon Gudkhally in 1840. The fever is next heard of at Sreenuggur, about 25 miles south-west of Gudkhally, in 1845, continued in that neighbourhood for years, and after carrying off nearly three-fourths of the population, extended eastwards and southwards. About the year 1850 it was raging at Gaurpotha, twelve miles north-east of Sreenuggur; then it spread westwards, and reached Oolah in 1856, cutting off 10,000 out of a population of 18,000 inhabitants. The fever then diffused itself over the southern part of Nuddea, the north-eastern part of Hoogly, and pretty generally over the district of Baraset, committing fearful ravages in many places.

[1] *Ind. Ann. Med. Science*, vol. xi.

The Burdwan epidemic began about 1862. It was very fatal in 1863 and 1864; diminished after the cyclone of 1864, and was little heard of in 1865, but reappeared in 1866 and 1867, after which it diminished somewhat, but still continued with considerable virulence for a number of years. It is stated that the Burdwan District lost 92,027 of its population between 1871 and 1880. Then we find the epidemic centre transferred anew to Nuddea in 1880, where it raged with great violence up to 1884, after which it decreased. Here are the fever death-rates at Nuddea for five years:—

1880, . .	26·11 per 1000.	1883, . .	27·60 per 1000.
1881, . .	35·54 ,,	1884, . .	29·22 ,,
1882, . .	30·50 ,,		

As Nuddea was the last district to suffer, we shall confine our attention to such general and local conditions of this locality as may be supposed to explain its liability to fever. The district of Nuddea is described as "a vast alluvial plain, intersected by six large rivers, numerous smaller channels, and by a labyrinth-like network of forsaken river-beds and old rivers in every stage of decay and effacement. It is dotted with lagoons and marshes, and studded with numerous towns and villages, which are frequently hidden in clumps of bamboos. The lands are closely cultivated. As in all deltoid formations, the fall of the country is away *from* the rivers, but the regularity of the slope is broken up by the tangle of rivers and river-beds, which cross and recross one another, and obstruct the natural lines of surface drainage."[1]

The water supply is of the worst possible quality; the villages are foul; the ground on which they are built honeycombed with holes made for obtaining mud for building the houses. These holes receive household refuse, and contain water of the foulest description, nearly all the year round.

This description of Nuddea is sufficient to account for epidemics of fever or of any other malady.

The following is the monthly distribution *per cent.* of 60,912 deaths from fever which occurred in this district in 1882, and the rainfall for the same year:—

	Jan.	Feb.	Mar.	Apl.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Percentage of Fever Deaths,	14·11	8·06	7·91	6·48	5·25	3·94	4·37	5·31	7·05	10·30	13·88	13·23
Rainfall, ...	0·09	0·78	0·59	1·07	5·13	9·61	10·65	12·50	9·23	6·81	1·16	0·04

The high mortality in January is to be ascribed to the conditions existing in the previous year (1881). June is the month of minimum fever prevalence, which attains its maximum in November and

[1] *S. M. I.* 1882.

December. The Burdwan fever is stated, in the report drawn up by Drs. Anderson, Palmer, and Elliot, to have attained its full height in August and September, but the heavy mortality lasted till November. It is further observed that "the first season has generally been less fatal to the invaded village than the second." Respecting the character of these fever epidemies very little is known. I have not met with any clinical records of cases, or any accounts of autopsies performed. No one appears to have thought it necessary to examine the blood microscopically. We have therefore to be guided by the general descriptions of the disease given by those medical men who inquired into the subject at the time. Dr. Elliot says that, in its milder forms, the Burdwan fever differs little from the ordinary intermittent and remittent fevers of the country, only it was aggravated by local circumstances. In its worst phases it assumed a "congestive remittent type," with a strong tendency to congestion of some vital organ, generally of the brain and lungs. In those who survived, after the acute symptoms had passed away, the fever generally became intermittent, of the tertian or quartan type, "or occurred at intervals of from five to fifteen days." The existence of a premonitory stage of general depression is assumed rather than proved. The first symptoms, in a certain class of cases, were a feeling of cold about the body, while the eyes, hands, and feet were burning hot. Then succeeded a severe shivering fit, the cold stage being so intense in the worst cases that the patient sometimes died in it without rallying. In other cases the cold stage was less severe, but the reaction was excessive, with delirium and coma, ending fatally in from thirty-six to forty-eight hours. Sometimes, during the hot stage, difficulty in breathing would set in, with mucous râles, death taking place by asphyxia. In the greater number of cases, however, the symptoms were those of aggravated remittent fever—shivering followed by heat of skin, then successive abatements and exacerbations of fever. If the crisis did not occur from the fifth to the seventh day, the fever often ran on for from seventeen to twenty-eight days, and the patient perished with all the symptoms of typhoid fever. After the fifteenth day, however, a remission or intermission generally occurred, and the heat of the skin and more urgent symptoms disappeared, leaving the sufferer in a dangerous state of exhaustion. This relief continued for some ten days, when the fever recurred, but in a less violent form, and lasted for a shorter time. The fever now assumed, we are told, a well-marked intermittent type, returning after an interval of fourteen days. Bowel complications were uncommon. By far the most frequent result of the fever was enlargement of the liver and spleen, especially

of the latter. Quinine in the earlier stages is said to have been of no use.[1]

The Nuddea fever is stated to have been mostly of an intermittent character, frequently degenerating into remittent. Some of those affected died of the first attack, while those in whom it took a more chronic form suffered from enlargement of the spleen and liver, with jaundice, dropsy, and general anaemia, which carried them off.

Fayrer thinks that the Burdwan fever may have been typhoid or typho-malarial in its nature. This view is not in harmony with the description given above, nor is it supported materially by the description of Dr. Jackson, which he quotes. Dr. Jackson, indeed, expressly states that he never saw any case that led him to connect the disease with enteric fever. According to him—and he appears to have seen a good deal of the disease in all its stages, but unfortunately had no opportunity of following individual cases from beginning to end—there were (1) a multitude of chronic cases, of which the type was almost always intermittent or remittent. In recent cases the intermission was quotidian, in the older cases quartan or quintan. (2) A small number of acute cases of continued fever, with no well-marked remission whatever. It is evidently respecting the nature of the latter class of cases that doubts may be entertained. They did not begin with rigors, but the fever followed after two or three days of malaise. The patient, we are told, had a stupid, drowsy, brain-poisoned aspect from the beginning, with intense prostration. Some of these cases proved fatal in three days, others lasted a week or ten days. In the cases that proved fatal the stupor passed rapidly into coma, and, after twelve or thirty-six hours of utter insensibility, death occurred. Hepatic or splenic tenderness or enlargement he found to be rare: and in this particular he differs widely from Elliot. The disease reminded him of typhus, but he never succeeded in finding any eruption. The first indication of the disease in a village was the occurrence of a few cases of the *jur-beekar;* in the ensuing year more of these cases would occur, and earlier in the season than the ordinary malarious fever, and would multiply with great rapidity as the year advanced. Hirsch, who quotes Lowe (*Madras Quart. Jour. of Med. Scien.*, 1866), which I have not seen, appears to think that the epidemic was, either wholly or in part, one of relapsing and bilious typhoid. Perhaps such cases did occur, and there is something about this *jur-beekar*, as described by Jackson, that renders it possible that some of the cases were really bilious typhoid; but if the description given above be at all accurate

[1] *Report on Burdwan Fever*, no date, probably Calcutta 1871.

the bulk of the epidemy does not appear to have been of this nature. I am afraid, however, that the nature of the Burdwan continued fever must remain to some extent a matter of conjecture; but of one thing we may be sure, that malaria was the dominating element in the epidemy. Frank relapsing fever, such as that described by Lyell as having occurred in 1852 in the Pesháwar district, could not have been overlooked if it had formed a considerable part of the epidemy.[1] It is a disease not unknown to Indian physicians; nor is it one presenting, as a rule, any difficulty in the way of diagnosis. This cannot, perhaps, be affirmed of bilious typhoid; but it is none the less certain that the bulk of the cases in the Burdwan epidemy was intermittent or remittent fever. There were also cases in which typhoid symptoms appeared at an early stage. A crisis apparently might occur on the fifth or seventh day, or the fever might run on without a break to the seventeenth or twenty-eighth day. The nature of the crisis is not stated. In many cases an amendment took place about the fifteenth day, followed in ten days by a relapse, which was of a milder nature than the first one. The disease then assumed an intermittent type, relapsing at intervals of fourteen days. This is not the history of bilious typhoid, in which the relapse is often fatal. An interval of ten days following a fever of fifteen days is not what is met with in bilious typhoid. Yet such is the account given of the course of the fever in a considerable number of the cases in the report already quoted. It is to be hoped that future epidemies in this region will be more carefully studied and more exactly described than those that have occurred in the past.

[1] *Ind. Annals of Med. Science*, Oct. 1854.

CHAPTER VI.

ENDEMIC AND EPIDEMIC MALARIA IN RAJPUTANA AND THE MEYWAR AND MALWA TABLE-LAND.

THE States of Bikanir, Jaisalmir, Marwar, and Shaikhawati constitute a vast sandy tract, destitute of rivers except the Loni or Luni, which fertilises the Marwar district in the south. The average temperature and rainfall of Bikanir, in the sandy desert of north-west Rajputana, and of Ajmere in the east, have been given in Chapter I.

Western Rajputana is reported to be one of the healthiest parts of India. Yet even here malaria is not by any means unknown. Moore remarks that "on the sandy plains of Marwar, where vegetation is at its minimum, where no marshy ground is found, and where water can only be obtained at an immense depth from the surface, the prevalence of enlarged spleen demonstrates the action of what we call malaria" (*Ind. Ann. Med. Scien.* vol. x.). Fever is more or less prevalent in the native States of Jeypore, Bhurtpore, Ulwar, Oodepore, and Jhalawar, but the present state of registration is not sufficiently advanced to enable us to judge to what extent it prevails.

The Ajmere and Merwara districts, under British rule, with a population of 460,722, occupy the crest of the great Rajputana watershed. The plateau on whose centre the town of Ajmere stands may be considered the highest point in the plains of Hindustan. The Aravalli range, which divides the plains of Marwar from the high table-land of Meywar, forms the distinguishing feature of the district.

Ajmere-Merwara possesses no rivers of any importance. The great tank embankments form the most interesting feature in the hydrography of the country. They are formed by damming up the gorges of hill streamlets. As many as 435 of these tanks are used for irrigating the country (Hunter).

The fever mortality in Ajmere-Merwara from 1877 to 1881 has been as follows:—

1877 to 1881 (average), . .	15·31	1883 (average), . . .	10·24
1882 ,, . .	11·68	1884 ,, . . .	13·95

The monthly distribution of the fever deaths per cent. for the four years 1881–84 is given in the subjoined table along with the average rainfall of Ajmere:—

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Monthly percentage of Fever Deaths,	8·91	8·09	7·93	7·21	6·78	5·49	6·79	9·55	10·86	9·48	9·20	9·54
Monthly Rainfall,	0·15	0·37	0·48	0·09	0·66	2·57	6·33	7·85	3·65	0·31	0·16	0·32
									Total,	.	.	22.65

Ewart gives the monthly percentage of admissions to strength amongst the Meywar Bheel Corps (Native) as follows:—

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
3·01	2·55	2·59	1·84	1·12	1·62	2·75	4·00	6·76	12·76	8·74	5·93

Of 2878 cases of fever treated, 2863 were intermittent, 8 remittent, and 7 continued. Of the 2863 cases of intermittent, 2503 were of the quotidian type, 291 tertian, and 69 quartan. From this it appears that the quartan type is more common in Meywar than in most parts of India. (*Ind. Ann.* 1859.)

To the south-east of Ajmere, at a distance of some ten miles, lies the cantonment and native town of Nasirabad or Nusserabad, which, with some other cantonments, has been minutely described by Hewlett (*S. M. J.* 1882). A few details respecting these stations will be of more value in throwing light upon the causation of malaria in this region than any general description. The following is given, as far as the necessity for condensation permits, in the words of Hewlett. Nasirabad is 1470 feet above the sea-level. Its rainfall is about 21 inches. It is situated on a sandy plain sloping to the south, 3½ miles from the nearest point of the Aravalli hills. The substratum consists for the most part of transition gneiss reached at a depth of a few inches in many places, while here and there bare rock appears. In some situations the soil is many feet in thickness. During the dry season water is found from 10 to 50 or 60 feet below the surface, and, as a rule, at the same depth in the rainy season. Hewlett thinks that the sub-surface rocky formation is irregular, containing hollows which are not self-draining, the whole being filled with disintegrated rock to a greater or less depth, and thus forming one of the apparently anomalous cases in which the effects of malaria are produced when there are no apparent marshy conditions. There is also a good deal of sub-marshy ground south-west of the camp. The water supply contains much soil-derived chlorine, as well as impurities of vegetable origin, and probably some of the wells are polluted with sewage. The soil absorbs much water during the rains. It is also impure, the site having been formerly occupied by native troops; "the risks inherent in the sub-surface are those resulting from the

retention of rainfall or drainage in hollows at no great depth below the surface."

The following table by Hewlett gives the aggregate fever-rates, with the monthly mean temperature and rainfall, for this station :—

Months.	Aggregate Fever-rates for Ten Years 1870–79.				Monthly Mean Temperature.	Monthly Mean Rainfall.
	Enteric Fever.		Other Fevers.			
	Admitted.	Died.	Admitted.	Died.	°	Inches.
January, . .	2	1	255	5	58·9	0·5
February, . .	...	...	236	...	70·0	...
March, . .	1	...	251	1	72·1	0·28
April, . . .	2	2	311	1	85·3	0·08
May, . . .	3	1	366	...	93·8	0·25
June, . . .	...	...	318	1	91·7	3·45
July, . . .	...	...	388	1	85·4	7·65
August, . .	3	3	568	1	83·8	4·69
September, . .	11	10	865	4	83·8	3·89
October, . .	8	2	891	2	80·8	0·25
November, . .	5	6	542	1	73·8	0·01
December, . .	5	2	273	...	65·4	...
Total, . .	40	27	5264	17	78·7	21·06

At Nasirabad, the enteric fever death-rate has been 4·24 per 1000, as against a death-rate for the whole Indian army of 2·03. Other fevers (including intermittent, remittent, and continued) gave a death-rate of 2·67 per 1000, while that for the whole Indian army was 1·42.

Dysentery and diarrhœa are slightly more fatal in Nasirabad than in the army generally, while cholera has been less so.

The fever admissions begin to rise very distinctly in August, attain their maximum in September and October, decline in frequency in November. This sudden rise in August is also noticed at Meean Meer. September is here the most fatal month for all fevers.

Neemuch, in Oodepore, is situated at the height of 1634 feet above the sea-level at the north, sloping to 1543 at the south end. Here, again, an impervious and irregular substratum retains water at 6 to 9 feet below the surface. In other parts the depth varies from 10 to 40 feet. For many miles outside the cantonment limits there is an area of depression, which, during and after the rains, is very nearly water-logged and marshy. The black cotton soil, of which for the most part it consists, is especially retentive of

moisture, and the prevailing breeze, during and after the rains, passes over this marshy ground towards the barracks.

The subsoil, during the rains, contains from 45 to 50 or more grains of moisture per ounce weight, with a subsoil temperature of 75° to 90° F., according to season. There is in the cantonment an artificial tank from which leakage takes place, and the soil over a large area below the dam is, during the monsoon season, and for some months after it, marshy, and tends to keep the ground under the barracks damp.

In some of the wells the subsoil water rises from 32 feet in June to within $6\frac{3}{4}$ in September. In one well, the water in July is $20\frac{1}{4}$ feet from the surface, and in September it rises to within $2\frac{1}{4}$ feet of the ground surface. The water is of fair quality, but that of the outside native wells is bad.

This is one of the most malarious stations in India, as will be seen by the following table:—

	Fever Admissions per 1000.	
	Neemuch.	Average of India.
Intermittent,	1058·0	389·4
Remittent,	247·7	162·2
Enteric,	5·4	4·6

The percentage of admissions, mean temperature, mean range, humidity, and rainfall at this station will be seen by the following table:—

Months.	Percentage of Fever Admissions.	Mean Temperature.	Mean Range.	Humidity.	Rainfall.
January,	3·09	61·8	29·7	28	0·00
February,	1·88	65·5	28·4	29	0·59
March,	1·98	77·1	30·1	23	0·18
April,	3·92	84·3	28·4	18	0·00
May,	4·38	88·3	29·3	17	0·40
June,	4·61	87·3	21·0	40	3·72
July,	5·01	80·3	10·9	80	15·87
August,	8·97	78·6	11·1	74	10·63
September,	19·05	78·6	15·9	61	2·82
October,	22·09	76·7	25·1	34	0·00
November,	15·84	68·5	29·9	25	0·00
December,	9·13	62·4	28·9	20	0·97

"The excessive rise in the fever admissions during the months

of September and October testifies to the intense malariousness of this locality."

Mhow, at an elevation of about 2000 feet, on an elevated ridge between the Gambhir and Santer rivers, is also notably malarious. It appears to owe this character, among other reasons, to the fact that the water gathers in the subsoil of hollows, rising in September to within a few feet of the surface. The fever here is almost entirely of the intermittent type. Remittent, continued, and enteric fevers are comparatively rare. Dysentery and hepatitis are also comparatively rare.

Fever here increases in a marked way in August, while the rains are still near their maximum, and attain its greatest prevalence in September, which is still a decidedly rainy month,—a fact which does not accord with the view that fever is the result of the drying-up process. To what are we to ascribe the maximum in the fever admissions here being earlier than at other parts of Western India? I see nothing in the rainfall that explains this. It may be noticed that a comparatively abrupt fall in the temperature takes place here in June, such as only takes place in October at Meean Meer. What may be looked upon as the autumn season appears at Mhow in advance of some of the other stations:—

Months.	Aggregate Fever Admission, 10 Years.	Mean Temperature.	Rainfall.
		°	Inches.
January, ...	3·65	66·3	0·12
February, ...	3·39	71·2	0·26
March, ...	3·80	77·7	0·29
April, ...	4·66	85·1	0·12
May, ...	5·19	86·9	0·32
June, ...	4·28	79·7	5·69
July, ...	5·50	77·1	8·38
August, ...	13·15	75·7	7·56
September, ...	21·22	76·2	7·11
October, ...	19·85	77·0	1·18
November, ...	9·82	71·3	0·28
December, ...	5·43	67·9	...
	104·47	76·0	31·31

CHAPTER VII.

ENDEMIC AND EPIDEMIC MALARIA IN THE LOWER INDUS VALLEY.

THIS region comprises the districts of Upper Sind Frontier, Shikárpur, Thar and Parkar, Haiderabad, and Karáchi. Upper Sind Frontier belongs to a rainless tract, the average rainfall being only 3·51 inches. It is thus entirely dependent on irrigation. In Shikárpur the average rainfall is 4·17. In the circle of Kandiaro, in the north of the Haiderabad district, water lies comparatively near the surface, so that a pretty large area of wheat is cultivated by water derived from wells (Hunter). In Haiderabad the average rainfall is about 7·99 inches ; in Thar and Parkar it is 11·47 ; and in Karáchi, 9·24 inches.

When we remember that at Bikanir an annual rainfall of about 14 inches being all absorbed by the soil suffices for the crops, scanty though they may be, it would be going too far to assert positively that the small rainfall in Sind can have no possible influence one way or another on endemic diseases; but there is good reason to believe that the comparative prevalence of endemic fevers in the different districts of Sind is much more closely related to irrigation than to rainfall, and that the varying intensity of fever in different years, so far as it is not owing to epidemic influences, is mainly determined by the extent of the inundations. This view is rendered all the more probable by the evident increase of fever mortality following very heavy rains in exceptional years, and also by the fact that, as a rule, the non-inundated country is less feverish than that subject to extensive overflows.

Taking Sind as a whole, the registered fever death-rate of the civil population is considerably under that of the Punjab and North-West Provinces. The difference, however, in favour of Sind, especially in the earlier years, may be partly owing to defective registration.

TABLE SHOWING THE RATIO OF FEVER DEATHS IN SIND FROM 1882 TO 1886.

	Ratio of Fever Deaths per 1000.	Rainfall.
Average of ten years 1873-82,	9·93	
1883,	11·42	5·86
1884,	14·47	7·27
1885,	12 90	6·32
1886,	15·63	

Jacobabad, in Upper Sind Frontier, is situated 60 miles from the Indus, at an altitude of 300 feet above sea-level, and is supplied with water by the Begaree and Noorwah canals, from the latter of which numerous minor canals are taken for the purpose of irrigation. Writing in 1857, Bond mentions that the subsoil water had risen at Jacobabad from 47 to 34 or 38 feet. Here the principal diseases, according to this authority, are fever and its concomitants. Fever is generally of the quotidian type, while enlargement of the spleen is common, especially among those who dwell in the lower localities and near the banks of the river. After the inundations, when the Indus has subsided, fever becomes so general that labour of every description is stopped. In these dry regions, the districts where moisture is most abundant are those that suffer most from malaria, and this appears to be the case in all dry countries (*Trans. Med. and Phys. Soc.*, Bombay, No. 14, 1857–58). The mean fever death-rate in Upper Sind Frontier is 8·17 per 1000.

Passing south to Shikárpur, Don informs us that the fevers appear after the first partial subsidence of the inundations in August, the remittent form preceding the intermittent, which latter is generally of the quotidian type. In the Haiderabad division, the northern districts of Kandiáro, Naushahro, Moro, and Sakrand suffer more from fever than do the central districts of Hala and Haiderabad, and these again have a higher fever death-rate than the southern districts of Badin, Tando Bago, and Dero Mohbat. The mean for the five years 1883 – 86 in these localities was as follows:—

	Average Annual Fever Death-rate.
Northern District, ...	19·55
Central District, ...	11·40
Southern District, ...	8·99

It is remarked by Hunter that the fevers so frequent in the northern division of Haiderabad are almost unknown in the southern portion, where there are no floods to leave marshy land behind them. Haiderabad and its neighbourhood is, at rare intervals, liable to heavy falls of rain. In 1869, 20 inches fell. and, as a result, the district suffered severely from fever.

Much more frequently inundations of unusual magnitude occur in the Haiderabad and Shikárpur districts, and these are usually, if not invariably, followed by excess of fever mortality. In 1882, vast tracts of land were covered for months with the water that overflowed from the canals. These districts became very unhealthy, and severe fevers, resulting in a largely-increased death-rate, followed. The year 1876 was another inundation year, and it is stated that the natives suffered greatly from ague. The admission-rate at Haiderabad among the troops was 1356·5 per 1000 against a ten years' average of 858·3.

In the Thar and Parkar district the mean fever death-rate for the ten years ending 1885 was 13·69 per 1000. Karachi had a mean fever death-rate for the same period of 12·63. The most feverish localities in Karáchi are Sehwan, Manjhand, and Kotri, which are situated inland on the western side of the Indus, which separates them from the Haiderabad district. Tatta and Sakro, to the south, also suffer considerably. Writing of Tatta, Inglis says that this "place was pretty healthy until the recess of the inundations and the partial drying up of the swampy grounds, when intermittent fevers began on the 20th August. In September and October they prevailed to a fearful extent, mostly quotidian, or double quotidian, with total absence or slight degree of cold fits, with malignant remittents" (*Trans. Med. and Phys. Soc.*, Bombay 1838–40). Karáchi rural circle had an average fever death-rate of 5·44 from 1883 to 1886, and the town circle had a fever death-rate of 12·29. This is by no means an excessive fever death-rate, especially if we consider that the fevers in the town of Karáchi are probably not so exclusively malarious in their nature as in Sind generally. The average death-rate per 1000 of the troops in Karáchi and Ghizree for the ten years ending 31st December 1881, from enteric fever, was 5·8; that from intermittent fever, *nil*; from remittent fever, 0·7; and from continued fever, 0·4. In Haiderabad for the same period, enteric fever caused a mortality of only 1·8 per 1000, and remittent fever 0·5. There were no deaths from the intermittent or continued forms. We may assume, therefore, that a considerable proportion of the fever deaths in the town of Karáchi are caused by enteric fever. One may almost wonder that the malarial death-rate is not higher, when we think of the description given of the place by Grierson (*Trans. Med. and Phys. Soc.*, Bombay 1859). He tells us that "there is an area of five square miles at Karáchi alternately covered and left exposed by the sea, and that there are other swamps in the neighbourhood. The native town is at the end of the harbour, about a mile and a

half from the camp, and is much exposed to the exhalations arising from the exposed mud and swamps."

It will be noticed that all the writers we have quoted agree in stating that fever in Sind begins as the inundations subside, and increases in frequency as the waters dry up. The table published by Dr. Coles (*Trans. Med. and Phys. Soc.*, Bombay 1855–56) shows the maximum of admissions among the European and native troops in Sind as taking place in October and November. This confirms, as far as it goes, the observations already quoted. But the period of the maximum fever death-rate in Sind among the civil population is very irregular. The annual fever curve, which is one of great amplitude, uniformly reaches its minimum in July or August, when the mean temperature is beginning to decline, but is still high; when the daily range is at its minimum; when the country is flooded, and when the scanty rainfall is at or near its maximum. There is a steady rise in the fever deaths from September to November and December, when the maximum is reached in half the instances. Sometimes the curve continues to ascend steadily until March, as happened in 1883; or, having attained its maximum in December, it may fall in January and February, to rise to a second maximum in March. The actual maximum of the year was attained in February or March in 1880, 1882, and 1883. In 1881, 1884, and 1885, it was reached in November or December. After March, the number of fever deaths falls steadily till it attains its minimum in July and August.

We shall give the average monthly fever death-rate of Haiderabad for the years 1880–85, the average monthly mean temperature, the daily range for 1879, and the average monthly rainfall:—

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Average Fever Death-rate, .	10·79	11·44	12·18	8·78	6·66	4·87	4·18	4·16	5·08	7·86	11·28	12·6
,, Mean Temperature,	62·8	66·3	79·4	86·0	90·9	90·8	88·3	85·8	86·5	83·3	72·0	62·3
,, Mean Daily Range,	29·5	27·9	26·2	32·1	31·1	29·4	20·5	18·5	22·0	27·4	30·1	28·2
,, Rainfall, . . .	0·18	0·16	0·10	0·07	0·04	0·52	2·71	3·54	0·58	0·01	0·07	0·01

If we were to judge of the fatality of malarial fever by the death-rates from this cause among the British troops in Sind during the last decade, we might naturally conclude that fever is more a troublesome than a fatal affection. This is true, in ordinary circumstances, as regards bodies of men well fed, clothed, housed, and cared for, and who are only compelled to live for a few years in a malarious locality. But it does not apply to the natives, who live under very different conditions, nor to troops less favourably situated during an epidemic of malarial fever. Such an epidemic, which has been described by Carter (*Trans. Med. and Phys. Soc.*, Bombay 1847), occurred at Haiderabad during the autumn of 1843. The

original article well deserves study by those who are interested in the subject. Here I can only give a *resumé* of some of the more salient features of the outbreak.

1st. The fever death-rate in May and June was abnormally high, a sure prognostication of the coming storm.

2nd. The mortality in all the numerous bodies of troops stationed in and around Haiderabad during the year was excessive, varying from 10 to 100 per 1000, or even higher.

3rd. The different bodies of troops, although all stationed within a circuit of a few miles of each other, suffered very unequally, and some of those occupying the hill suffered more than those encamped on the plains.

Such being the general facts respecting the incidence and fatality of this epidemy, let us turn to the characters of the disease itself.

Its commencement was sudden. Pains in the body and limbs, bilious vomiting, high-coloured urine, and costive bowels, were followed by a severe paroxysm of fever, generally quotidian, sometimes tertian or irregular in type. Occasionally the fever was remittent, rarely continued. The paroxysm lasted generally from eight to ten hours, and was usually complete in all its stages. Its liability to recur at short intervals was the worst feature of the disease. The average time from discharge to readmission was four days. Symptoms of local inflammation were rare, those of local congestion common. The fever frequently commenced with vomiting of blood, always of bilious matters, and it sometimes terminated by a discharge of blood by the anus. Profuse bleedings from the nose attended it. Singing in the ears, amaurotic affections, violent pains in the head, deafness, and vertigo were common. When in the first part of August a fatal case occurred, it generally took place during an attack of quotidian fever. After several severe accessions, insensibility came on during a paroxysm, and terminated in death: at a later period, however, dysentery, supervening upon a debilitated constitution, rapidly put a period to the existence of all who were attacked by it.

CHAPTER VIII.

EPIDEMIC MALARIA IN KUTCH AND GUJARAT.

THE island of Kutch, the peninsula of Kattiwar, with the adjoining lowlands of Palanpur, Baroda, Broach, and Surat, form a region where the rainfall is heavier than in Sind, which is not subject to canal irrigation, and is less affected by inundations.

Kutch lies to the south of Sind, having the Rann of Kutch on the north, north-east, and south-west, and the Gulf of Kutch on the south.

The Rann forms an immense salt marsh of 6000 square miles, surrounding Kutch on three sides. It begins to fill with water about the middle of April. This water is partly thrown up from the ocean during the south-west monsoon, and is partly formed by the rains swelling the rivers Loni, Banas, and smaller streams. It begins to empty and dry up by evaporation in August. In December it is in many places dry, the exposed sand being encrusted with salt. In other places it is in the condition of a salt swamp, while again in parts it is covered with a thin layer of water. The wind blows from the south and south-west for ten months in the year, but in October and November it frequently blows from the north across the marsh towards Kutch. Moore, from whom these particulars are taken, states that endemic disease is most prevalent during the months of October and November, when the Rann is drying up; and he remarks that the place would be still more unhealthy, or almost uninhabitable, if it were not that the prevailing winds blow to, and not from, the Rann. The unhealthiness of the Province is attributed by him to the mephitic exhalations arising from the great salt swamp.[1] I have only to say that the facts do not appear to me sufficient to prove that Booj, the capital of Kutch, or the country as a whole, is exceptionally unhealthy.

It is to be regretted that we have no information respecting the health of the population along the shores of this great salt swamp.

Deesa, in Palanpur, is situated on the banks of the Banas, about 55 miles inland from the Rann. It has an annual rainfall of 25 inches, the months of heaviest fall being July and August.

[1] *Trans. Med. and Phys. Soc.*, Bombay 1860.

Here the maximum of fever admissions occurs in October, as is said to be the case in Bhooj. Murray (*Army Medical Report*, 1859) says that "fever is the disease *par excellence*, and the mortality in proportion to cases treated is even greater than in the Presidency, and double that of Poona or Belgaum, forming nearly one-half of the total mortality." He adds, "dysentery is an affection of very rare occurrence."

At Rajkot, in Kattiwar, the rainfall is 27·34 inches; the months of May and October are those when the maximum of fever admissions occurs.

Gibson notices the prevalence of malaria in the Dang or jungly district in the southern portion of Gujarat. He observes that at Durrumpore, where the soil is of the red variety, fever is less common than in neighbouring localities where the soil is black. In the jungly region fever is said to be of the remittent type, followed by dropsy, dysentery, general scorbutic diathesis, and anæmia. In the open country he observed little fever after November; while in the jungly region it is even more frequent in December and January. Between the Tapti and Nerbudda he met with a bad form of remittent fever, assuming a typhoid type, called *Kim Chokie*, or red tongue fever, characterised by a brick-red tongue, dry skin, and early delirium. At Kim Chokie there is no jungle, and the surrounding cultivation is mostly dry. He found enlarged spleen and cachexia to be more common in the jungly regions than in those that are open and dry.

In the Gujarat division of Bombay the fever death-rate among the civil population is higher than in Sind; higher, indeed, than in any part of the Bombay Presidency. We shall give the death-rate for the five districts which comprise the division for the ten years 1873–82:—

	Rate of Deaths per 1000.
Surat, . . .	19·24
Broach, . . .	23·46
Kaira, . . .	18·15
Panch-Mahals, . .	16·58
Ahmedabad, . .	21·12

Surat may be taken as representing this region.

We shall first notice the relation of the annual fever death-rate to the amount of rainfall at Surat:—

Years.	Fever Death-rate per 1000.	Rainfall.
1880, . . .	20·39	32·50
1881, . . .	23·87	29·87
1882, . . .	17·40	42·94
1883, . . .	22·27	50·17
1884, . . .	21·65	40·34
1885, . . .	22·27	38·54

The fever death-rate remains remarkably uniform; but it is to be remarked that the highest fever mortality, viz. in 1881, coincided with the lowest rainfall, and the lowest death-rate (1882) with the second highest rainfall.

The average monthly percentage of fever deaths during the above period among the civil population, the average fever admission per 1000 of the native troops from 1841–52, the average temperature, and the mean daily range for 1880, are as follows:—

	Percentage of Fever Deaths.	Admission-rate of Native Troops.	Rainfall.	Mean Temperature.	Daily Range.
January, . . .	9·00	33·26	0·00	70·1	32·1
February, . . .	8·29	19·99	0·04	72·7	29·8
March, . . .	9·01	19·32	0·00	79·9	32·4
April, ...	7·52	28·75	0·00	84·4	27·5
May, ...	7·23	39·67	0·13	85·4	18·8
June, ...	6·46	33·30	9·90	84·4	13·1
July, ...	7·36	65·53	12·48	81·7	9·1
August, . . .	8·13	72·75	10·87	80·7	11·0
September, . . .	7·68	108·71	7·07	81·0	12·7
October, . . .	7·96	68·12	1·19	80·3	20·9
November, . . .	10·95	66·95	0·10	75·6	24·4
December, . . .	10·29	57·04	0·04	70·9	28·0
		613·39	41·82	78·9	21·7

We gather from this table that fever is most prevalent in September among the troops, and the most fatal months among the civil population are November and December. The last three months of the year were also the most fatal among the troops—October being the month when most deaths took place, that is, the period of fever deaths followed a month after the period of fever prevalence.

CHAPTER IX.

ENDEMIC AND EPIDEMIC MALARIA IN BOMBAY CITY AND SUBURBS.

The city of Bombay has a much smaller fever death-rate than that of most other parts of the Presidency, averaging in recent years about 8 per 1000. In 1885, out of 6648 deaths from fever, 5186 were ascribed to remittent fever, 1171 to simple continued fever, and 281 to ague. Only 10 deaths were ascribed to typhoid fever. It must not be concluded, because remittent fever is the most fatal, that it is the most common form. We may be sure there must have been a large number of cases of ague to furnish 281 deaths. In Ceylon, as we shall afterwards see, about one case of ague in a thousand proves fatal. If the proportion were about the same in Bombay, there would have been 281,000 attacks of ague in the year 1885 out of a population of 773,196; and as the Ceylon statistics refer to hospital cases, which we may assume are more than usually severe, we may well conclude that this estimate is much under the mark.

In Bombay more females than males die of fever. "The highest proportional mortality occurs in infants under one year, and the mortality remains high until the third year. From the third up to the seventh or eighth year it falls, until a minimum death-rate of 1·12 males and 2·76 females per 1000 is reached. From the ninth year till over thirty the mortality fluctuates, although falling heavier on the females." The poor and wretched suffer much more than the well-to-do. The fever death-rate among Europeans is 2 per 1000; among the Parsees, 5 per 1000; among the Hindoo low castes it is 12; and among the Jains it reaches 17 per 1000. The fever mortality is not in proportion to the density of the population. Dr. Weir, who kindly furnished me with information respecting the prevalent disease, during one of my visits to India, points out the important *rôle* that dampness, arising from imperfect drainage, plays in the causation of fever in Bombay. Epidemics of malarial fever in the city do not depend upon the annual rainfall. The fever deaths rose from 5867 in the year 1876, to 12,832 in

1877. In Bombay, the annual rainfall in 1877, at the Colaba Observatory, was 0·35 of an inch, and at the Byculla Hospital it was 9·77 inches under the average. The mortality, although it diminished, remained high for the next two years. The year 1882, with an average rainfall, was the healthiest of recent years. It is important to notice that in the year 1877 fever did not confine its ravages to the poor alone: the fever deaths were excessive among Brahmins, Parsees, and Europeans. The Brahmin mortality rose from 9·70 in 1876 to 14; the Parsee from 4·24 to 5·42; and the Europeans from 1·51 to 4·13. This indicates the existence of a general influence affecting the whole city and its inhabitants.

We shall recur to this epidemy presently. In the meantime, in order to see in what manner fever prevalence and mortality are related to each other, and to the monthly temperature and rainfall, we have compiled the following table, which gives—1st, The average monthly rainfall and mean temperature of Bombay; 2nd, The monthly proportion per cent. of 1503 cases of intermittent fever treated in the General Hospital, Bombay, during the five years 1838–43; 3rd, The monthly percentage of 326 cases of remittent fever admitted into the same hospital from 1st April 1846 to 31st March 1856; 4th, The monthly ratio per 1000 of admissions among the European troops for fevers generally from 1830–46; 5th, The monthly ratio per 1000 of fever deaths during the same period; 6th, The monthly distribution per cent. of 38,873 fever deaths occurring in Bombay city from 1880 to 1885:—

	Rainfall.	Mean Temperature.	Intermittent Fever.	Remittent Fever.	Ratio of Admissions per 1000 of Troops.	Ratio of Deaths per 1000 of Troops.	Distribution of Fever Deaths in Bombay City.
January, . .	0·12	72·7	5·9	7·3	36·67	1·03	9·3
February, . .	0·02	74·2	3·2	4·6	32·72	0·65	8·4[1]
March, . . .	0·00	78·2	4·4	3·7	49·22	1·11	9·3
April, . . .	0·04	81·7	4·5	2·1	55·54	0·58	9·1
May, . . .	0·59	84·2	8·6	8·0	54·27	0·73	8·9
June, . . .	20·89	82·7	12·7	11·1	89·58	2·16	7·5
July, . . .	24·17	80·8	9·5	13·2	117·38	2·66	7·7
August, . .	15·15	79·7	8·6	14·4	88·87	2·44	8·4
September, .	10·81	79·5	7·1	7·7	85·68	1·32	7·7
October, . .	1·62	80·3	18·9	9·9	145·92	2·74	7·6
November, .	0·49	79·7	10·6	9·9	117·01	1·75	7·5
December, .	0·04	74·8	5·3	8·0	84·05	2·17	8·5

If we are to accept the admissions into hospital as indicating the

[1] The February ratio only appears less on account of the fewer number of days in the month.

seasonal evolution of malaria at Bombay, we shall conclude that intermittent fevers are at their minimum from December to April, during the cold and dry season; that they increase considerably in May, and especially in June, decrease in August and September, then attain their maximum in October and November. Remittent fevers, on the other hand, begin to increase in May, when the temperature is at its maximum, and go on increasing in June and July, when the weather is hot and rainy, attain their maximum in August, and then become less frequent. The maximum of fever deaths among the civil population does not occur coincidently with the period of greatest prevalence of either form of fever, but is spread pretty uniformly over the cold and dry months from December to April. A rise, however, takes place in August, when remittent fever is at its maximum. It would appear as if, in ordinary years, the fever proved fatal by relapses occurring during the cold weather.

In epidemic years, such as 1877, the fever death-rate follows a very different curve, as will be seen from the following figures. I add the monthly rainfall for the same year:—

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Fever Death-rate, .	5·3	5·8	9·8	11·8	12·6	10·3	7·6	7·8	7·4	7·2	6·6	7·4
Rainfall, . . .	0·13	0·02	0·00	0·04	0·48	20·97	24·08	15·12	10·61	1·59	0·45	0·04

It will be seen by comparing the rainfall of 1877 with the average given in the previous table, that when the fever began, and up to the time when it attained its maximum, there was nothing special about the rainfall of the year. Indeed, excepting that the fall was rather scanty, its distribution was normal throughout the various months.

The monthly mean temperature that year was 2·5 above the normal. The number of fever deaths began to increase in March, which was a dry month, and attained its maximum in April and May. This seems to form an exception to the general rule, that epidemics of malarial fever occur only in autumn. The disease in the city of Bombay in 1877 was, probably, of the remittent type and whether it was purely malarial may be open to doubt.

CHAPTER X.

ENDEMIC AND EPIDEMIC MALARIA IN THE WESTERN AND EASTERN COAST REGIONS.

THE narrow strip of country lying between the base of the Western Ghauts and the Arabian Sea, comprising Ratnagiri, North and South Kanara, Malabar, and Travancore, belongs partly to the Bombay Government and partly to that of Madras; but it will be convenient to take the whole coast together, as it constitutes physically one region continuous with the Eastern Coast Districts.

This region is in general low, traversed by numerous streams, in places abounding in lagoons, having a heavy rainfall, and covered with luxuriant vegetation. Notwithstanding the presence of so many conditions apparently favourable to malaria, this extensive tract, as a whole, must be regarded as one of the healthiest in India. This is especially true of the southern part of the coast. In the Ratnágiri collectorate the mean fever death-rate for the ten years ending 1884 was 9·75. Northern Kanara is decidedly less healthy, the fever death-rate for the same period having been 19·05.

Hunter states that in 1860 a severe epidemy of fever broke out, and, gradually spreading over the whole of this district, extended eastwards into the rice tracts of Dhárwar and Hubli. During 1861 and 1862 the fever raged with great severity both along the sea-coast and in the Dhárwar and Hubli subdivisions, which are situated inland.

To the south of this, again, fever becomes much less severe. Thus at Cannanore, Calicut, and Malliaporam the admissions from paroxysmal fevers among the troops in 1880 was 68·2, and for continued fevers 45·99 per 1000, with no deaths. In 1881, paroxysmal fevers gave a ratio of 11·51, and continued fevers of 15·35, per 1000. The average for the Western District, which now includes Belgaum, Cannanore, Calicut, and Malliaporam, for the five years 1882–86, was 19·21 per 1000 of admissions, and no deaths.

The dysentery admissions for the same period gave a ratio of 65·95, and the deaths 0·47.

Annesley points out that the mingling of salt and fresh water in the lakes, inlets, and marshes along this coast does not cause much fever. He explains this by the sandy nature of the soil, the absence in it of vegetable matters, and the extent to which it is cultivated.[1] The chief characteristics of the climate are the constancy of the rains, in amount sufficient to keep up saturation of the soil, the high mean temperature, and the moderate daily range.

The chief town of South Kanara is Mangalore. The average rainfall here is 140 inches, and the mean temperature of the year is about 84° F. The agricultural population who have to work in the neighbourhood of jungles is said to suffer considerably from fever. The inhabitants of the town, according to Annesley, have an unhealthy, leuco-phlegmatic appearance.

Cochin is situated in a narrow belt of level land scarcely above the sea-level, and saturated with a heavy rainfall.

Day gives us the monthly percentage of 3048 cases of fever treated at the dispensary, which indicates that fever is most prevalent here from October to December.[2] I add the average rainfall and mean temperature :—

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Percentage of 3048 Cases,	6·89	6 59	7·44	6 00	7·28	6 90	9·10	9·67	8·59	10·00	11·25	10·10
Rainfall, . . .	0·99	0·76	2·26	4·37	12·82	30·51	22·46	12·56	9·52	11·72	4·80	1·92
Mean Temperature, .	77·3	79·0	82·0	83·7	83·0	80·8	78·4	77·6	77·8	79·0	78·8	79·3

The Eastern Coast Districts and the plains of Trichinopoly, lying between the Eastern Ghauts and the sea, enjoy in the greater part of their extent the same comparative freedom from malaria as on the west coast.

The fever death-rates of the civil population at Tangore for the five years ending 1882 was 2·5 per 1000, while a five years' average at Tinnevelly gave a mortality of 5·1 per 1000.

It is possible that this small fever death-rate is partly the result of defective registration, but the low admission and death rate from fever of the troops stationed at Madras, St. Thomas' Mount, and Pallaveram justifies us in believing that the Eastern Coast line is comparatively free from fever. The mean admission-rate for 1882–86 in this division was 38·44 per 1000, and no deaths; for dysentery, 94·86 per 1000 of admissions, and 2·26 per 1000 deaths.

The following table gives the mean temperature, daily range,

[1] Annesley, *Diseases of India*, Lond. 1841, p. 100.
[2] *Quart. Journal of Med. Scien.* 1861.

and rainfall of Madras, and the average monthly proportion of fever deaths during the three years 1880–83 :—

Months.	Mean Temperature.	Mean Daily Range.	Rainfall.	Monthly Distribution of Fever Deaths.
January, . .	73°·6	15°·5	0·79	9·9
February, . .	74·7	18·9	0·30	9·0
March, . .	78·9	18·7	0·41	7·9
April, . . .	82·7	16·3	0·66	7·1
May, . . .	86·7	18·6	2·22	7·7
June, . . .	87·3	20·3	2·00	7·3
July, . . .	84·8	17·5	3·81	8·1
August, . .	84·4	19·0	4·46	9·1
September, . .	82·1	16·9	4·75	8·9
October, . .	80·1	12·3	10·86	7·9
November, . .	75·3	10·2	13·68	7·1
December, . .	75·0	11·7	5·17	9·4

We observe here, as at Bombay, two periods of maxima, one at the end and beginning of the year, and one in the hot season.

To the north of Madras the Districts of Godavery, Vizagapatam and Gangam have fever death-rates of from 10 to 18 per 1000.

CHAPTER XI.

ENDEMIC AND EPIDEMIC MALARIA ON THE TABLE-LAND OF THE DECCAN

CENTRAL PROVINCES.

The ratio of fever deaths per 1000 for the ten years ending 1887 was as follows:—

1878, . . .	29·50 [1]	1883, . . .	19·86
1879, . . .	18·34	1884, . . .	16·48
1880, . . .	18·46	1885, . . .	19·35
1881, . . .	16·35	1886, . . .	20·01
1882, . . .	17·31	1887, . . .	19·20

The higher lands of the Vindhyan range draining into the valley of the Ganges are far from exempt from malaria, which, indeed, is excessively common in the jungly tracts; but, as a whole, the elevated tracts of Sleemanabad, Murwara, and Bijeragogarh suffer less than the level plains of the Hiran and Nerbudda.

The Satpura division, notwithstanding its elevation of 2000 feet, suffers considerably, especially the level undrained localities in Chhindwarra and Seoni, where the soil is of the black cotton variety, and the rice-fields of Balaghat, where cultivation is carried on by means of dams that obstruct drainage and give rise to large swamps.

The great Nagpur plain, comprising the valleys of the Wardha and Wainganga, suffers very unequally in different parts. The jungly tracts in the Wardha district are severely affected; and limited localities in the Nagpur and other districts, such as the cantonment of Kamptee, where neither swamp nor jungle exists, are also in a marked degree malarious.

In the Vindhyan and Nerbudda divisions the maximum fever death-rate (taking the average of the five years ending 1887) falls on October. In Satpura, the months of September, October, and November are about equally unhealthy; while in the other divisions September is the month most charged with fever deaths.

We shall give the monthly percentage of fever deaths, temperature, and rainfall for the district of Damoah for 1886, and the

[1] Famine year.

monthly percentage of fever deaths and the rainfall for Chhindwarra for 1885 and 1886, as illustrating the relation of fever mortality to the meteorology of the Provinces. The year 1885 was a year of epidemic fever in the Chhindwarra and Seoni Districts, which appears to have continued into the beginning of 1886. The normal distribution of fever deaths in these Provinces will be understood from that of Damoah:—

Months.	Damoah.			Chhindwarra.			
				1885.		1886.	
	Fever Deaths.	Rainfall.	Temperature.	Fever Deaths.	Rainfall.	Fever Deaths.	Rainfall.
January, .	5·1	0·00	63°·3	2·8	0·00	12·5	0·00
February, .	6·0	0·26	67·8	3·6	0·91	10·5	0·00
March, .	7·1	0·02	78·0	4·6	1·52	9·7	0·23
April, .	7·4	0·00	85·2	4·7	0·05	10·0	0·00
May, . .	7·3	0·67	88·4	5·1	0·49	7·8	1·08
June, . .	6·8	7·02	85·5	4·5	10·54	5·0	6·27
July, . .	5·7	22·97	77·5	7·8	7·99	5·4	12·88
August, .	9·2	9·53	76·4	15·0	6·94	7·6	2·56
September, .	10·2	0·74	77·2	13·8	2·49	8·3	0·28
October, .	12·1	9·52	75·5	13·6	3·59	8·1	6·23
November, .	11·8	0·00	70·2	13·7	0·18	8·4	0·15
December, .	10·6	1·51	64·1	10·5	4·76	6·5	0·45

The worst affected localities in 1885 were Chhindwarra and Seoni. The rainfall in the former was below the average from June to October; in the latter it was under the average from June to November, excepting July, when the fall was 2·5 inches above the normal; the temperature, excepting in August, when it was 0°·4 under the normal, was somewhat excessive. Although, as will be seen by the above table, the mortality attained its maximum in August, a comparison of the monthly fever deaths in that year with those of preceding and following years makes it evident that fever had begun to prove more than usually fatal as early as March. Here, again, we find an epidemy manifesting itself at an early period of the year, and the maximum of deaths occurring in advance of the usual period. In Seoni the lowlands were those most affected in 1885, but in 1886 these escaped, and the epidemic influence made itself felt in many of the high-lying localities.

The fever during this epidemy is described as of a remittent type, lasting, as a rule, for seven, eight, or twelve days, terminating, in a certain number of cases, either by sweating or diarrhœa. When it proved fatal there was a gradual reduction of strength, low

delirium, and sudden and unexpected death from failure of the heart's action. Those that recovered were left in a state of prostration, associated with jaundice, enlarged liver and spleen, and general anasarca.

The fevers met with in ordinary years, in the Central Provinces, are continued fevers in the early summer, followed, after the rains have begun, by the remittent and intermittent forms.

Kamptee, to which we have alluded, is situated at an elevation of 900 feet above the sea-level. The cantonment, which has proved exceedingly unhealthy, extends four miles along the south bank of the river Khanán, which here follows a tortuous course from west to east, and at Kamptee passes over a sandy and rocky bed. Except in the rainy seasons, the river is fordable and free from mud. On the south-west of the barracks the ground is low, and liable to become swampy during the heavy rains. The soil consists of clay, and the regar or black cotton soil so common in the Deccan. Water is found at a depth of from 30 to 40 feet. The country around the cantonment is flat, and destitute of wood.[1] The following table gives the average annual number of admissions and deaths per 1000, for the years 1880–84, for fevers, cholera, dysentery, diarrhœa, and hepatitis:—

	Admitted.	Died.
Paroxysmal Fevers,	605·85	0·75
Continued Fevers,	37·70	0·71
Enteric Fever,	9·50	3·51
Cholera,	8·51	3·95
Dysentery,	26·57	0·75
Diarrhœa,	49·83	0·22
Hepatitis,	17·78	1·22

Geddes[2] gives the proportion of the various forms of fever occurring monthly among the European troops, who, for the greater part of the period to which the observations refer, were stationed at Kamptee.

The figures are as follows:—

	Continued.	Ephemeral.	Intermittent.	Remittent.	Total.
January,	4	0	48	22	74
February,	10	3	27	11	51
March,	9	6	41	21	77
April,	8	12	49	21	90
May,	22	10	86	28	146
June,	27	16	78	36	157
July,	20	9	70	41	140
August,	13	2	146	64	225
September,	18	1	170	135	324
October,	14	4	129	118	265
November,	13	7	88	45	153
December,	9	6	58	17	90

[1] Murphy, *Army Medical Report*, 1862.

[2] Geddes, *Clinical Illustrations of Disease in India*, Lond. 1846.

CHAPTER XII.

ENDEMIC MALARIA IN THE NIZAM'S DOMINIONS.

I HAVE little information respecting the extent to which malarious diseases prevail in the extensive country comprising the Nizam's Dominions. The chief military station occupied by the English is Secunderabad, and it is only in respect to this station that I have been able to obtain trustworthy statistics.

Secunderabad is situated at an altitude of 1800 feet above the sea-level; the soil is granitic; the rock brittle, coarse, granular, easily fractured, and rapidly disintegrated by ordinary meteorological influences. Its *débris* forms a compact laterite. The ground on which the camp is built contains much organic matter. The cantonment is in close proximity to rocky hills and marshy valleys. The soil is subject to sudden and complete saturation, followed by desiccation.[1]

We shall here give the ratio of admissions and deaths per 1000 of the troops from paroxysmal fevers for the ten years ending 1885:—

	Admissions.	Deaths.		Admissions.	Deaths.
1876, . .	102·9	0·30	1881, . .	76·63	0·00
1877, . .	129·27	0·00	1882, . .	58·64	0·00
1878, . .	204·22	0·89	1883, . .	62·83	0·00
1879, . .	392·28	0·64	1884, . .	47·78	0·00
1880, . .	106·72	0·40	1885, . .	39·74	0·41

This represents the condition of this station in a favourable light as regards admissions, although the death-rate for some years stands high.

The monthly prevalence and fatality of the different forms of fever at this station, and their relation to rainfall and temperature, will be understood from the following table compiled by Day (*Ind. Annals of Med. Science*, 1858). The average temperature and rainfall have been added to the original table. The figures refer to native troops.

[1] Crawford, *Army Medical Report*, 1860.

Months.	Ephemeral Fevers admitted.	Intermittent Fevers admitted.	I. F. died.	Remittent Fevers admitted.	R. F. died.	Total admitted.	Total died.	Monthly Percentage of total admitted.	Average Rainfall.	Average Mean Temp.	Mean Daily Range 1880.
January, .	6	955	6	34	2	995	8	6·34	0·31	70°·4	31°·8
February, .	3	821	8	44	3	868	11	5·53	0·26	75·6	29·5
March, .	3	956	8	29	2	988	10	6·30	0·77	82·0	31·3
April, . .	10	994	4	44	1	1048	5	6·68	0·66	87·0	29·1
May, . .	11	896	3	33	3	940	6	5·99	1·49	88·3	28·9
June, . .	21	758	2	28	0	807	2	5·15	3·61	82·2	19·7
July, . .	20	1256	5	47	1	1323	6	8·45	5·75	77·1	15·8
August, .	14	1719	1	94	1	1827	2	11·65	5·63	77·1	18·4
September, .	22	1861	6	86	12	1969	18	12·56	5·08	76·4	16·7
October, .	11	1668	9	66	2	1745	11	11·12	3·47	76·0	20·41
November, .	13	1561	13	60	3	1634	16	10·42	0·65	72·2	20·1
December, .	14	1464	15	62	5	1540	20	9·81	0·23	69·4	26·0
	148	14,909	80	627	35	15,684	115	100·00	27·91	77·8	23·98

The dry weather, from January to June, is the healthiest season. A rise in the admissions, both from intermittent and remittent, occurs in July. Intermittent fever attains its maximum prevalence in September, and the remittent type a month earlier, viz. in August. It will be observed that the maximum prevalence of the intermittent variety coincides with a rainfall only slightly below the maximum, and not with the drying up of the rains. The temperature reaches its maximum of 88°·3 in May, and by September it has already fallen 12° below this point. This probably accounts for the earlier appearance of the autumnal maximum here than at most parts of India. The maximum of deaths from the remittent form follows one month after its maximum prevalence, while intermittent fever proves most fatal in November and December.

CHAPTER XIII.

ENDEMIC MALARIA IN THE WESTERN DECCAN.

KHANDESH is the most northerly section of the Deccan on the west To the south of the Tapti river is the great plain watered by the Girna, stretching from Burhanpur to Nandarbar, which is composed of rich alluvial soil. To the north of the Tapti the land rises towards the Satpura hills, in the neighbourhood of which is the waste jungly tract known as the Pal Tappa, which is said to have become deserted in the seventeenth century owing to famine. This region is extremely unhealthy.

Irrigation is much practised in Khándesh. The country along the Tapti, Girna, and Panjhra rivers suffers occasionally from destructive floods.

The ratio of fever deaths in the Khándesh collectorate, for the ten years 1873–82, is given at 15·82 per 1000, and in the Násik collectorate to the south of Khándesh, at 17·70.

Gibson[1] states that the Ghaut country north of Násik is comparatively open, there being few hills, and only scattered jungle, but that fever there is common. In the country under the Chandor hills the soil rapidly deepens, and the country is healthy. He holds that, as a rule, deep soils are more healthy than shallow soils in this part of India. To the south of Násik are the Districts of Ahmednagar, with a fever death-rate (1873–82) of 16·94; Poona, with 14·61; Sholápur, with 14·74. To the south of these lie Sátára, Belgaum, Dhárwár, and Kaládgi, with fever death-rates respectively of 17·74, 16·19, 18·27, and 17·22. Poona, at an elevation of 1800 feet, with a population of 90,000, is situated in a treeless plain on the small river Moota, near its junction with the Moola. The cantonment for the infantry and horse artillery is from one to two miles west of the city; that for the cavalry is at Kirkee, about two miles north-east of the city. The two barracks to the west of the town present a singular contrast as respects salubrity. The Wanowrie barracks are healthy; the Ghorpuri barracks are the

[1] *Trans. Med. and Phys. Soc.*, Bombay, vol. ii.

reverse. This will be seen by comparing the average admissions from paroxysmal fevers in these two barracks during a period of eleven years:—

Ghorpuri, ...	652·09
Wanowrie, ...	324·85

There is about a mile between these two places. The Wanowrie barracks stand 100 feet higher than the Ghorpuri lines. The soil and subsoil of both are essentially the same, only the soil of the Ghorpuri lines contains more organic matter. The drainage of the Ghorpuri lines, however, seems to be defective, and to the windward is a large area under wet cultivation, which comes to within 600 yards of the barracks. There is also a large stream with swampy black mud immediately in rear of the camp. The water supply is good and abundant. This instance shows the influence of local conditions in the causation of fever.

The subjoined table shows the monthly prevalence and fatality of fever at Poona among the European troops, 1830–46 (Webb), and the mean temperature and rainfall of this station:—

Months.	Admissions.	Deaths.	Rainfall.	Mean Temperature.
January, ...	26·882	0·539	0·29	71°·8
February, ...	36·289	0·232	0·06	76·0
March, ...	39·558	0·267	0·24	83·3
April, ...	48·424	0·475	0·51	85·7
May, ...	61·963	0·693	1·61	84·4
June, ...	66·123	0·315	5·84	79·0
July, ...	55·812	0·480	6·28	75·8
August, ...	40·985	0·565	4·99	74·9
September, ...	38·453	0·550	4·64	75·4
October, ...	48·735	0·542	4·62	77·8
November, ...	63·151	1·054	0·60	75·9
December, ...	53·297	0·769	0·21	72·2
	579·610	6·481	29·89	77·7

Among the civil population of the Western Deccan the maximum fever mortality most frequently falls on August, but it is occasionally postponed to September or October. It is only in exceptional years, and unusually healthy ones, that it is postponed to November and December.

CHAPTER XIV.

ENDEMIC MALARIA IN MYSORE.

It now only remains for us to take a glance at the southern part of the great Indian table-land, and we shall restrict our remarks to the two military stations of Bellary and Bangalore.

The District of Bellary lies to the south of the Nizam's Dominions. It is secured by the Western Ghauts from the full force of the S.W. monsoon, and, from its position, it profits little by the N.E. monsoon, which is spent before reaching it. During the dry season most of the streams disappear, and the country is only rendered habitable by the existence of wells, tanks, and dams constructed to retain the water. The town stands at an elevation of 1450 feet above the sea-level. The district fever death-rate for 1883 was 5·8 per 1000. The town death-rate was 9·9. The water supply of the town is bad; the drainage is also defective, which may account for its insalubrity as compared with the rural districts.

I am indebted to Surgeon-General Tarrant for the fever statistics of the troops stationed at Bellary and at Bangalore.

Bellary.

Months.	1883.	1884.	1885.	1886.	1887.	Means.		
	Ratio of Admissions per 1000.	Ratio of Admissions per 1000.	Ratio of Admissions per 1000.	Ratio of Admissions per 1000.	Ratio of Admissions per 1000.	Average Admission-rate.	Average Rainfall.	Average Temperature.
January, .	13·55	2·27	0·00	3·00	8·00	5·36	0·10	73°·4
February, .	16·59	3·69	0·00	4·00	0·00	4·85	0·05	78·6
March, . .	25·09	2·95	0·00	1·00	2·00	6·20	0·60	86·1
April, . .	4·95	1·01	0·00	5·00	1·00	2·39	0·82	89·2
May, . .	12·09	2·04	1·13	0·00	0·00	3·05	1·90	88·5
June, . .	5·05	1·02	0·00	0·00	0·00	1·21	1·86	83·5
July, . .	6·11	0·00	0·00	2·00	1·00	1·82	1·45	81·4
August, . .	9·20	0·00	0·98	8·00	14·00	6·43	2·32	80·8
September, .	22·49	2·09	0·00	11·00	23·00	11·71	3·69	80·2
October, . .	13·19	3·82	0·00	24·00	12·00	10·60	3·93	79·5
November, .	24·41	0·00	0·87	12·00	43·00	16·05	0·73	75·9
December, .	6·04	0·00	1·82	6·00	84·00	19·57	0·28	73·1
	158·76	18·89	4·80	75·00	188·00	89·24	17·73	81·7

Bangalore is situated at an altitude of 3000 feet. The formation is granite, gneiss, or felspar. The gneiss decomposes readily on exposure to the air, and what seems to be rock can often be broken up by the pickaxe. In the valleys the soil is a rich alluvium, cultivated by means of irrigation. The subsoil water is deep. The drinking-water is derived from tanks not free from pollution.

BANGALORE.

NORTH STATION HOSPITAL.

Months.	1883. Fever Admission-rate per 1000.	1884. Fever Admission-rate per 1000.	1885. Fever Admission-rate per 1000.	1886. Fever Admission-rate per 1000.	1887. Fever Admission-rate per 1000.	Means. Fever Admission-rate per 1000.
January, .	4·79	4·44	1·29	Hosp. closed	3·97	3·62
February, .	7·51	1·78	0·00		3·71	3·25
March, .	6·30	1·96	1·41		1·74	2·85
April, . .	3·49	0·00	Hospital closed.	0·00	4·18	1·92
May, . .	3·38	2·16		1·17	4·08	2·69
June, . .	3·42	0·00		1·15	3·22	1·95
July, . .	8·00	3·26		4·53	0·80	4·15
August, .	10·46	0·00		1·15	3·97	3·89
September, .	6·75	0·00		2·40	3·21	3·09
October, .	4·55	0·00		5·86	2·47	3·22
November, .	2·01	0·00		0·98	0·82	0·95
December, .	2·77	0·00		4·97	2·51	2·56
Total, . .	63·43	13·60	2·70	22·21	34·68	34·14
Average Strength for Year,	885	963	175	626	1187	

SOUTH STATION HOSPITAL.

Months.	1883. Fever Admission-rate per 1000.	1884. Fever Admission-rate per 1000.	1885. Fever Admission-rate per 1000.	1886. Fever Admission-rate per 1000.	1887. Fever Admission-rate per 1000.	Means. Fever Admission-rate per 1000.
January, .	8·23	3·28	1·95	3·26	0·00	3·35
February, .	3·08	3·41	0·00	2·16	1·00	1·93
March, .	5·01	5·17	2·23	0·00	2·01	2·89
April, . .	2·02	4·58	0·00	1·08	2·05	1·95
May, . .	8·47	3·48	1·00	1·07	0·00	2·80
June, . .	7·57	9·31	0·00	5·35	0·00	4·45
July, . .	14·11	8·35	3·00	3·14	1·01	5·92
August, .	8·71	13·85	0·99	2·05	3·00	5·72
September, .	2·18	12·59	0·96	2·03	5·01	4·55
October, .	4·39	6·86	0·00	4·89	0·00	3·23
November, .	4·35	3·16	3·92	0·89	0·00	2·46
December, .	4·44	6·23	0·00	0·00	0·00	2·13
Total, . .	72·56	80·27	14·04	25·92	14·08	41·38
Average Strength for Year,	959	1044	986	970	879	

From the above table it will be seen that Bangalore is remarkably free from malarious disease, comparing favourably in this respect with Bellary in the north. The months of July, August, and September are those in which fever amongst the European troops is most prevalent; while in Bellary, the months of September, October, November, and December are those most charged with fever admissions. It is open to doubt whether the fevers occurring at Bangalore in this season are actually caused by malaria, or whether, being a noted haunt of enteric fever, the summer fevers are not frequently rather cases of mild enteric.

Kurnool and Cuddapah, in the north of Mysore, and both on the table-land, although politically parts of the Madras Presidency, are amongst the most unhealthy districts of Madras, returning fever death-rates of from 16 to 22 per 1000.

In the Kurnool District, where fever is intense, the maximum fever deaths (1888) occurred in January, the minimum in October;

whereas in the more elevated Nilgiris region the maximum falls on May and June, and the months from April to July form the fever season. The same distribution is observed in Simla, Darjilling, and other hill regions in India.

Having now entered very fully into the various circumstances affecting the prevalence and seasonal distribution of fever in India, it only remains to state a few of the more important conclusions to which our study has led us as to the influence of weather and season, altitude and soil, on malarial fever.

1. In India, as a whole, fever mortality is highest during the three last months of the year or in January; although it seems probable that the autumnal and winter fevers are contracted during or towards the end of the warm and rainy season.

2. The remittent and continued forms (some of the latter probably not malarious) are most common in the summer or early autumn months.

3. The effect of altitude on the prevalence and seasonal distribution of malarial fever is equivalent to a displacement to a more northern latitude. Fever being, as a rule, less severe at high elevations, the fever season becomes changed from autumn to April, May, and June. Thus, fever is most prevalent during these months at the hill stations; but when the region is an elevated valley, the fever may be very intense, and, in such a case, the usual seasonal distribution proper to the plains will obtain.

4. The fever season is related to temperature in the following respects:—

(*a*) The season at which malaria prevails is determined by the temperature, or rather by season, which is regulated by temperature. It thus occurs at the same season of the year, other things being the same, both in dry and wet regions.

(*b*) A protracted high thermometric level during several months is accompanied by a correspondingly protracted period of high fever prevalence; whereas, when the temperature falls rapidly after attaining its maximum, the curve of fever prevalence is also acute, exhibiting a rapid rise and a rapid descent.

(*c*) An earlier maximum temperature and an earlier marked fall in the mean temperature, is accompanied by an earlier attainment of the fever maximum.

5. In intensely malarious regions, fever, without ceasing to be autumnal, attains its maximum prevalence earlier than in less malarious districts.

6. In epidemic years, fever begins to manifest itself at an early period of the year before the rains set in; and during the autumn the period of highest fever prevalence is in advance of that which is usual in the same locality.

7. True epidemic fever is not determined, although it may be modified, by temperature and rainfall.

8. Local epidemics are frequently connected with heavy rainfalls or inundations.

9. Rainfall only affects the seasonal prevalence of malaria under certain conditions, to which we shall advert in dealing with Ceylon. Rainfall is not the essential, or, in ordinary circumstances, a potent element in regulating the fever period.

10. Rainfall has an important influence on the prevalence and intensity of endemic fever; but this influence depends to a large extent on the nature of the soil, the facilities of drainage, and the period of the fall.

11. In India, the black cotton soil, which is very retentive of moisture, is notably malarious.

12. Water-logged soils, on which the ground-water rises near to the surface, are favourable for the development of endemic fever, with anæmia and splenic enlargement.

13. Fever of a severe form is, in some instances, endemic on dry and sterile soils, such as that of Meean Meer.

14. Soils of the same nature, and in neighbouring localities, may prove widely different as regards salubrity—probably from a difference in drainage. A remarkable instance of this kind is that in connection with the Wanowrie and Ghorpuri lines at Poona.

15. Some localities having a high temperature, a heavy rainfall, and excessive vegetation, and studded with lagoons, are met with along the coasts, which are remarkably free from malarial fevers; the inhabitants of which, nevertheless, exhibit some of the symptoms of chronic malarial poisoning. The soil of such districts is usually light and porous, and the temperature, although high, is equable.

CHAPTER XV.

ENTERIC, TYPHUS, AND RELAPSING FEVERS, INFLUENZA, AND DENGUE.

Enteric Fever.—Enteric fever was formerly regarded as exceedingly rare in India, although it is now recognised as one of the most fatal diseases of the young European soldier during the earlier years of his sojourn in India. It is generally held, up to the present time, that the disease is rare among the natives of India. In support of this view, the small ratio of cases occurring among the native troops is insisted on. It appears that, out of regard to native prejudices, autopsies are not regularly performed in fatal cases of fever occurring among the native troops,—a circumstance which lessens considerably the weight of this argument. It will probably be found that enteric fever is not so rare among the natives of India as is generally supposed, although it is undoubtedly much less frequently met with among them than among the newly-arrived Europeans.

The following table gives the enteric fever death-rate in the Indo-European army and in each of the three Presidencies for the ten years 1870–79, and for the six years 1880–85. The deaths for each year from 1871 to 1888 has been given in a previous table (p. 315):—

	Army of India.	Bengal.	Madras.	Bombay.
1870–79, . . .	2·03	2·28	1·42	1·75
1880–85, . . .	2·89	3·18	1·79	2·77

In the native army enteric fever is said to have caused an average death-rate (1881, 1882, 1884) of 0·1 per 1000. In the jails the proportion of deaths among the natives from enteric fever is about the same as in the army. Enteric fever is met with throughout every part of India, but some stations are more affected than others. In the Bengal Command, the stations where the disease is specially prevalent are Fyzabad, Meerut, Lucknow, Pesháwar, and Cherat; in Madras, Bangalore and Secunderabad; and in Bombay, Neemuch, Karáchi, and Nasirabad. The Presidency division of Bengal appears to be that where enteric fever is least prevalent.

The monthly distribution of enteric fever admissions in the European army in different parts of India is shown in the sub-

joined table. The averages for Bengal are for the fourteen years ending 1883,[1] and those for the Bombay Presidency for the ten years 1870–79.[2]

Monthly Percentage of Admissions for Enteric Fever in India.

	Gangetic Provinces (813 cases).	Rohilkund and Meerut (378 cases).	Punjab (791 cases).	Peshawur and Kurum Valleys, Marston (143 cases) (1879).	Agra, Central India (281 cases).	Bombay (401 cases)
January,	6·3	3·9	4·7	2·80	4·3	5·5
February,	4·5	1·9	3·8	0·70	3·2	5·2
March,	6·6	5·6	6·6	3·50	5·3	4·0
April,	16·0	15·4	8·5	12·59	9·3	8·5
May,	15·6	25·9	15·9	30·76	9·3	8·5
June,	8·2	9·5	16·7	14·68	1·8	3·7
July,	5·0	6·1	9·5	11·19	2·5	3·5
August,	9·2	4·2	7·7	8·39	13·9	10·5
September,	10·6	11·4	8·6	8·39	23·8	17·4
October,	6·4	6·6	6·8	2·10	14·2	13·9
November,	5·4	4·5	5·8	2·80	8·9	11·7
December,	6·0	5·0	5·4	2·10	3·5	7·5

In the Bengal Presidency enteric fever attains its maxium in the second, while in Central India and Bombay it is the third, quarter in which the greatest number of cases occurs.

In Madras the seasonal incidence of enteric fever is similar to that of Central India and Bombay. In 1883, ninety-four admissions were thus distributed per quarter:—

1st Quarter.	2nd Quarter.	3rd Quarter.	4th Quarter.
7	14	60	13

Enteric fever, as we have already observed, is especially a disease of the young soldier, who is most liable to attack during the first years of his Indian service. The following table exhibits the relationship between fever and the age and length of service. The figures give the means for the period 1877–84:—

Deaths from Enteric Fever per 1000 at various Ages and Lengths of Service.

Ages.			Length of Service.		
Under 25 years.	From 25 to 30 years.	From 30–34.	1st and 2nd year.	3rd and 6th year.	7th to 10th year.
4·84	2·18	0·9	6·0	1·9	0·7

The nature and causation of enteric fever in India demand our special consideration, as the subject is one of great importance, and one respecting which there is great difference of opinion.

[1] *S.M.I.* 1883–84, p. 55. [2] *S.M.I.* 1882–83, p. 296.

The main facts respecting the symtomatology of the disease, the ages most liable to the infection, its comparative prevalence among natives and Europeans, and its pathological lesions, are admitted by all. It is in the interpretation of these facts that differences of opinion arise. Is the disease, as seen in India, identical with the enteric fever of Europe ?[1] Is it, in India, a climatic disease, or is it one of the forms of remittent fever—the fatal stage of the more protracted cases ? Are the intestinal lesions to be accepted as proof of its specific character, or are such lesions common to many forms of fever, climatic and malarial ? Such are some of the questions which have been long under discussion, to which no satisfactory answer has yet been given, and to which, although we shall state our conclusions, we do not pretend to give a final answer.

Let us state the facts respecting this fever which are admitted by all:—1. The disease is one which chiefly affects the young soldier shortly after his arrival in India. No less than 65·2 per cent. of the admissions occur in the case of those who have had less than two years' service, and the liability not only diminishes with advancing age, but in a still more marked manner with prolonged residence in the country. But these features are not peculiar to the disease in India. Enteric fever is everywhere a disease of the young. Murchison found that 52 per cent. of the cases brought into hospitals were in persons from fifteen to twenty-five years old. Everywhere those who have recently arrived in a country or district where the disease prevails, are most liable to contract the infection. The young French soldier suffers from enteric fever in Algeria, just as the English soldier does in India.

2. The young soldier is, however, more liable to contract enteric fever in India than in England. In 1880 the death-rate from continued fevers in the United Kingdom was 0·26 per 1000. This includes enteric fever, typhus fever, cerebro-spinal fever, simple continued fever, and febricula. In India, for the same year, the enteric fever death-rate alone was 3·63 per 1000. Enteric fever thus occasions more than ten times as many deaths in India as in England.

From this we conclude that the causes of the disease are more commonly diffused, or more intense, in India ; or, on the other hand, that the effect of the Indian climate on the constitution of the newly-arrived European renders him more liable to contract the infection.

3. The lesions met with after death from typhoid fever are essentially the same in India as those seen in Europe.

[1] Professor Bernhard Fischer of Kiel has lately discovered the Eberth-Gaffky bacillus in specimens of the spleen and mesenteric glands from two fatal cases of enteric fever in India, which had been forwarded to him for examination.—*Lancet*, June 6, 1891.

4. Enteric fever is a rather rare disease among the natives of India. This is proved by the mortality returns of the civil population, of the prisons, and of the native troops. Thus in Bombay, in the year 1885, out of 21,850 deaths from all causes, fever accounted for 6648; but of these only ten are ascribed to enteric fever, and it is to be remarked that four out of the ten are registered as having occurred in Europeans. These figures, doubtless, vastly understate the actual prevalence of enteric fever in Bombay, but they show none the less that it is not a common disease in this part of India. The jail statistics confirm this inference. In 1881 only 14 out of a total of 4440 deaths were caused by enteric fever, while intermittent fever gave rise to 121, and remittent and continued fevers to 241 deaths. In the native army in 1881, with a strength of 114,612, the death-rate from enteric fever was 0·09 per 1000. In the European army, with a strength of 58,728, the death-rate was 2·64 per 1000. But while the native troops suffer much less than the Europeans from enteric fever, they are proportionally more liable to die of what is regarded as the remittent forms of malarial fever. The English army in India had a death-rate of 0·72 per 1000 from malarial fever in 1881; that of the native troops for the same year was 2·66. This inverse relation between enteric and malarial fevers in the two armies naturally suggests the question, whether the enteric fever which attacks the young European in India is not merely a form of malarial fever taking the place of the remittent fever which prevails among the native troops. Another view which seems seldom to have suggested itself to Indian physicians is, that much of what is called remittent fever in India is not truly of malarious origin, but allied to enteric fever.

5. The disease, in an unknown proportion of instances, exhibits the usual symptoms, and follows the ordinary course of typhoid fever elsewhere; but more generally it differs in both of these respects from the disease as seen in Europe. The rose-coloured lenticular spots are often absent.[1] The temperature curve differs notably from that depicted by Wunderlich. In India the disease often begins abruptly with rigors, the temperature rising, within a few hours, to 103°, 104° F., or even higher. Fayrer quotes the following from Professor M'Connell of Calcutta: "There is the great difficulty in the diagnosis. In all the cases I have seen here and verified by *post-mortem* examination, neither the course of the

[1] Of 31 cases that occurred at Lucknow in 1882, diarrhœa was present in 24, rose spots in 21, and abdominal tenderness in 6 only.—*S.M.I.* vol. xvi. p. 56. See a paper by Innes on "Enteric Fever," *Army Medical Report*, 1878.

fever nor the range of temperature has been at all typical, and the presence of rose spots, or of any specific eruption, has been quite exceptional."[1] Hewlett says that many of the cases returned as enteric fever begin either as intermittent, remittent, or continued fever, enteric complications arising in the course of the disease; and further, that abdominal symptoms, so marked as to attract attention, are sometimes wanting in cases in which a *post-mortem* examination reveals the presence of ulceration in the solitary or agminated glands of the lower part of the ileum.[2] Enteric fever is sometimes associated with tonsillitis and sore throat.[3]

6. Enteric fever in India can only in exceptional cases be traced to specific infection. Hewlett expresses, I believe, the general experience of Indian physicians when he says, "That there seems to be no ground for believing that enteric fever, which annually attacks and destroys so many young soldiers in India, is in all, or even in the great majority of cases, due to a specific poison derived from the intestines of a previously affected person."[4] Almost equally difficult is it to trace the disease to the contamination of breathing air, drinking water, milk, or food with non-specific fæcal matters. In short, in a majority of cases no specific or pythogenic cause of the disease can be traced either in sporadic or epidemic cases. Instances of a great number of cases occurring within a given area dependent on a particular water supply known to have been contaminated by fæcal matters, and restricted to such area, or of widely-scattered cases traceable to contaminated milk, or of house epidemics caused by sewage gases, are almost unknown in India. Upon all these points in connection with enteric fever, almost all observers are unanimous. Crawford points out that at almost every post occupied by the European troops co-operating with the various columns in Afghanistan, extending from the British frontier up to Kabul and Kandahar, cases of enteric fever appeared; and he adds that some of these posts and camps must in all probability have been occupied for the first time during the late campaign. Now this is precisely what has been remarked as regards the analogous affection observed in the United States, South Africa, and elsewhere. It often appears among bodies of men encamped on virgin soil, in circumstances in which the existence of a germ derived from a previous case is out of the question.

Before proceeding to discuss the nature of the Indian enteric fever, let us briefly state the views held in Europe respecting the etiology of the disease.

[1] Fayrer, *Climate and Fevers of India*, Lond. 1882. [2] *S.M.I.* vol. xvi. p. 298.
[3] *S.M.I.* vol. xviii. p. 54 (see description of the disease in South Africa).
[4] Hewlett, Report on Enteric Fever, quoted in *S.M.I.* vol. xvi. p. 298.

"It has been proved," as Bristowe says, "beyond all cavil that enteric fever is above all fevers the fever of fæcal decomposition; that it occurs only among those who are exposed to the influences of defective drains or foul overflowing cesspools, especially when these are situated so as to pour their gases into the interior of inhabited houses, or to contaminate, by their emanations, their soakage, or their leakage, water and other articles used for foods."

No one at the present day denies that the excreta of enteric fever, either as they pass from the patient, or, at least, after undergoing development in soil or water, are capable of communicating the disease to a healthy person. The only question is whether the disease may not have an autochthonous origin as well. Murchison, Griesinger, and many others have held that the cause of typhoid fever develops spontaneously in putrefying organic substances. Hence the name of pythogenic fever applied by Murchison to the disease. The difficulty in many, say the impossibility in some, instances of establishing the continuous transmission of the disease,—the difficulty especially of accounting for isolated epidemics occurring in localities in which no previous case of typhoid fever is known to have existed, it may be, for a quarter of a century before,—and for its sporadic occurrence in such out-of-the-way places as Norfolk Island, are considerations which still incline some to believe in the autochthonous origin of the disease. If we are to include with typhoid fever so-called, mucous and gastric fevers that are sporadically met with, the difficulty of establishing a continuous transmission of the disease is in no way diminished.

Notwithstanding these difficulties, which are real, the theory of a specific origin by continuous transmission has been steadily gaining ground. It seems, in fact, to be the only one consistent with a belief in the specificity of the disease, and this is seldom called in question in Europe. Liebermeister, who is a staunch supporter of the specific nature of enteric fever, says "that the real cause of every epidemic, and of every isolated case, is only the specific poison of typhoid fever. All the numerous conditions which have been called causes, are not real causes. If the specific poison is absent, every other evil influence may act on the population without producing typhoid fever. No matter how well a field is manured, wheat will not grow unless wheat has been sown."[1]

In order to account for the appearance of the disease in localities where it has been absent for years, and into which no new case has been recently imported, it is assumed that the infective micro-organism

[1] Ziemssen's *Cyclopædia*, vol. i. p. 61.

may remain latent in the soil for long periods. This assumption, it will be observed, does not account for the appearance of the disease in remote districts where human beings have never previously resided.

Let us see how far the facts observed in Europe, and the theories founded on these facts, apply to the Indian disease.

As regards the essential pathological lesions, the two diseases are identical.

The symptomatology of the two affections, on the other hand, present, as we have seen, many points of difference, especially in the frequent absence of the rose-coloured spots and of abdominal symptoms, and in the departure from the typical temperature curve in the case of the Indian disease. Yet it is not to be forgotten that in Europe typhoid fever often enough differs in its mode of evolution from the normal type. In the abortive and latent forms, for example, the symptoms and progress of the disease are decidedly abnormal in every particular.

We may well hesitate to pronounce the Indian fever a distinct disease, merely on account of the more or less frequent, and more or less pronounced, departure from an arbitrary type, when we reflect that in Europe differences as great are met with in a very considerable number of instances. I am inclined to agree with Marston, "that enteric fever in India is, both in its clinical phenomena, *when taken as a whole*, and in its *post-mortem* appearances, perfectly identical with what is elsewhere known as enteric fever."[1]

It is when we come to the etiology of the disease that the real difficulty arises. We are not lightly to call in question the results of the painstaking investigations of the Indian surgeons. They have laboured to trace the fever they meet with in India to the same causes to which it is due in England. Their early teaching has prejudiced them in favour of a theory which their experience in India has failed to support. Unless we wish to fit our facts to a theory, we must frankly admit that in the majority of cases, neither the pythogenic nor the specific theory of typhoid, as understood in Europe, can be used to explain many of the outbreaks of enteric fever that are yearly witnessed and investigated in India.

The impossibility of tracing the disease to fæcal decomposition, specifically contaminated or otherwise, has led many to regard the disease as the result either of climatic causes or of malaria.

Against the climatic theory may be urged the improbability that high temperature, vicissitudes of temperature, humidity or dryness of the atmosphere, or any other meteorological conditions, are capable of giving rise to a fever with lesions so definite and specialised.

[1] Marston, *Army Medical Report*, 1880.

The more specific objections to the theory of the climatic origin of the disease are as follows :—

1. Typhoid fever is found alike in very dry, in very moist, in very hot, and in comparatively cold districts of India.

2. It does not attain its maximum under similar climatic conditions. In Bengal, the North-West Provinces, and the Punjab, the disease is most prevalent in April, May, and June; that is, in the hot and dry season. At Nasirabad, and at many other places in Central India, and at Bombay, it is most common in August, September, and October; that is, when the temperature has fallen very considerably, and when the rains still continue, although in diminishing amount.

3. Its prevalence differs greatly in localities having pretty much the same temperature and rainfall. Thus, at Karachi and Ghizree, for the ten years ending December 1881, the death-rate from enteric fever was 5·8 per 1000; while at Haiderabad, in Sind, having almost the same rainfall and temperature, it was only 1·8 per 1000. The same thing is observed at Nasirabad and Neemuch; in the former the death-rate was 4·8, in the latter 2·6, although the climate of the two places is very much the same.

4. The manner in which the disease occurs in certain barracks in a cantonment, while the rest of the barracks escape, is not explicable on the climatic theory of the disease. If it were purely climatic in its origin, we should expect to see it affecting all parts of a cantonment indifferently.

These considerations appear to me to militate strongly against the view that it is a climatic disease.

More can, no doubt, be said in favour of its malarious character. It is true that in many cases enteric fever in India seems at the outset to present many of the symptoms of remittent, and sometimes those of intermittent fever. It has also been urged that congestion and ulceration of the intestinal canal is not uncommon in the course of protracted fevers of malarious origin. But this has not been satisfactorily proved, and is an evasion of the real issue, which is rather this: Are tumefaction and ulceration of the solitary and agminated glands in the lower part of the ileum, with enlargement and softening of the related mesenteric glands, lesions proper to uncomplicated malarial fever? Are such lesions found, for example, in autopsies of persons who die during undoubted epidemics of malarial fever, such as that which occurred at Amritsar in 1881? I think not. No doubt a patient may be attacked with enteric fever who is also suffering from the malarious affection, and in such cases the symptoms of the latter disease will modify those of the former during

life, and also the lesions after death. I doubt very much whether the special lesions of enteric fever are ever met with in true malarial fever.

If the malarious infection be capable of producing genuine enteric lesions, these ought to be frequently met with in autopsies of the natives, who succumb in such large numbers to all the forms of malarial fever; but this we know is not the case; nor do we find that, in the more malarious regions of Europe and America, ulceration of the agminated glands of the intestine is observed as the result of purely malarious disease. Where the pathological lesions of enteric fever are met with in an autopsy, the inference therefore is that the fever from which the patient died was enteric and not malarious in its nature.

We must now inquire what conclusions as to the nature of Indian typhoid are to be derived from a study of the geographical, topographical, and seasonal distribution of malarial and enteric fever in India.

If enteric fever be a malarious disease, that is, if it be caused by the infection which gives rise to intermittent fever, we should expect it to be more frequent in those regions, localities, years, and seasons, in which malarial fevers are most prevalent. Is this the case? Looking first at the general distribution of two fevers or forms of fever over large areas, as exhibited in their incidence on the three Presidencies, it will be seen that enteric and malarial fevers have a similar distribution; both are most frequent in Bengal, slightly less so in Bombay, and both are considerably less common in Madras. This indicates that the climatic conditions which favour the prevalence of the one favour also that of the other. When, however, we come to examine their relative prevalence in individual localities in each Presidency, it seems to be the exception rather than the rule to find both fevers to be endemic in the same places. Certainly it would not be difficult to name localities where they are both notably frequent. Thus, in the Shal valley, according to O'Farrell, "sunstroke, enteric fever, pernicious ague, cholera, diarrhœa, dysentery, abscess of the liver, epidemic pneumonia, tonsillitis, bronchitis, and jaundice are all very common;"[1] but such general pathological *foci* clearly do not count. It more frequently happens that malarious *foci* are comparatively exempt from enteric fever, and *vice versa*. There are, it is true, no malarious districts where enteric fever is unknown, for the disease is met with everywhere throughout the peninsula, from the Himalayas to Cape Comorin, and from Assam to Afghanistan; but if there is no antagonism between the two diseases as regards the localities in which

[1] *Army Medical Report*, 1885.

they occur, there is often a marked want of correspondence as respects their prevalence in particular districts.

In Madras we find Secunderabad and Bangalore to suffer from frequently recurring outbreaks of enteric fever, but neither of these localities are in any high degree malarious. Secunderabad, for example, had an average admission-rate for malarial fever (1882–86) of 67·39, and a death-rate of 0·15 per 1000; and Bangalore shows a still more favourable record in this respect. Yet we find the enteric fever death-rate of Secunderabad not unfrequently to reach 2·5 or 3·0 per 1000; and at Bangalore the deaths from this disease in 1882 and 1883 averaged 6·0 per 1000; the death-rate of the army of India for the period 1870–79 from enteric fever having been 2·03 per 1000.

Turning to the Bombay Presidency, the same want of correspondence between the prevalence of the two diseases is very observable. The fever admissions at the Bombay station (excluding enteric fever), for the ten years ending 1881, presented a mean of 1001·9 per 1000, while the enteric fever death-rate was as low as 0·6 per 1000. At Karachi and Ghizree, on the other hand, where the fever admissions were 944·5, the death-rate from enteric fever averaged no less than 5·8 per 1000. At Poona and Kirkee the admission-rate for malarious fever during the same period was 675·6, and the death-rate from enteric fever 1·6 per 1000; while at Asirgarh the admissions for malarial fever averaged 910·8, and the death-rate from enteric fever only 1·2 per 1000. Nasirabad, again, had an average annual admission-rate for malarial fever of 704·8, with the high enteric fever death-rate of 4·8 per 1000; while Neemuch, with nearly double the malarial admission-rate, viz. 1344·4, had an enteric death-rate of little over one-half of that of Nasirabad, or 2·6 per 1000. Mhow has a bad reputation for the prevalence of malarious fever, but enteric fever furnishes only a moderate number of admissions.

The same want of correspondence between the prevalence of malarial and enteric fever in particular localities in Bengal could be abundantly illustrated; but we shall content ourselves by remarking that few, if any, of the hill stations, which are comparatively free from malaria, have escaped from fatal outbreaks of enteric fever.[1] The conclusion to which these facts seem to point is, that the general conditions, probably climatic, which favour the prevalence of malarial fever, are also favourable to the prevalence of enteric fever, but that the local conditions on which malaria depends are not necessarily those that determine the spread of enteric fever.

[1] Clarke describes an outbreak of typhoid at Jutog, at an altitude of 7000 feet (*Ind. Ann. Med. Science*, 1868).

We shall now compare the seasonal distribution of enteric and malarial fever in India, in reference to the question of the malarial nature of Indian typhoid. This part of the subject may be considered under four heads—(1) The relation, in point of time, between general and local epidemic outbreaks of the two diseases. (2) The relation between the annual mortality from malarial and enteric fevers. (3) The relation between the annual admission-rates from the two fevers. (4) The monthly distribution of the two diseases.

1. Little attention has hitherto been given to the question as to whether enteric fever increases or diminishes in frequency during the great epidemic extensions of malaria. In the very severe local outbreak of fever at Amritsar in 1881, which has been already described, when the fever death-rate rose to 86·1 per 1000, it is expressly stated that no enteric lesions were observed in the bodies of those who died from the disease. Conversely, we meet with local outbreaks of enteric fever coinciding with a moderate or low prevalence of malarial fever. The three stations of Lucknow, Cawnpore, and Sitapur furnished the largest number ef enteric deaths in Bengal in 1882. The admission-rate for malarial fever at the three stations was 336, and the death-rate 1·11 per 1000; whereas the death-rate from enteric fever at these places was no less than 11·1 per 1000. In 1888 the greatest prevalence of enteric fever in any district of Bengal was in Rohilkund, the ratio being nearly 35 per 1000, which was nearly double that of the previous year. The district ranking next, as regards the number of admissions, was Oudh, where the ratio was 27·2 per 1000. Now, we find it stated that these were the two districts in which malarial fever was least prevalent, and that in both the ratios were under those of the previous year. There was thus a double want of correspondence as respects the relative prevalence of these two diseases.

2. By referring to a table already given (page 315), showing the annual death-rates of the European troops in the three Presidencies (1871–88) from malarial and enteric fevers, it will be seen that the years when enteric fever is most prevalent are not necessarily the years when malarial fever makes the greatest number of victims. A notable rise in the enteric fever death-rate of Bengal is observed to have taken place in 1878, a year when the death-rate from malarial fever was by no means excessive. In the years 1879 and 1880 the death-rates from both diseases were high in Bengal, and in the latter of these years in Bombay. The year 1886 was remarkable for the high ratio of deaths from enteric fever, and for a correspondingly low rate of mortality from malarial fever; and it deserves to be noticed that the year 1886 was one marked by a

high death-rate from enteric fever in all the Presidencies, which seems to show that the conditions favouring its spread may extend at one and the same time over considerable tracts of the earth's surface, and that the greater or lesser prevalence of the disease is not entirely dependent on the local pollution of water, or other sanitary defects in individual localities, although these are doubtless not without their influence in the spread of the infection, but to influences of far-reaching effect. The gradually diminishing mortality from malarial fever observable during the past ten years is doubtless to be ascribed to a growing tendency on the part of army medical officers to return a larger proportion of deaths, from what was formerly regarded as malarial, continued, and remittent fevers, as due to enteric fever; and these changes in medical opinion as to the nature of fevers, diminish greatly the value of the statistics, as bearing upon the relative prevalence of the enteric and malarious elements in different years, and perhaps more particularly as regards the severer forms that end in death.

3. A comparison of the annual admission-rates for the two affections, for the five years ending 1884, is shown in the following table:—

Period.	Bengal.		Madras.		Bombay.	
	Admissions per 1000.		Admissions per 1000.		Admissions per 1000.	
	Enteric Fever.	Malarial Fever.	Enteric Fever.	Malarial Fever.	Enteric Fever.	Malarial Fever.
1880,	8·7	809·6	2·6	450·1	9·5	1117·3
1881,	6·3	763·9	0·9	278·7	4·2	840·6
1882,	7·3	660·0	4·0	171·5	5·1	558·5
1883,	8·1	486·4	8·6	128·4	5·7	436·4
1884,	12·6	682·8	11·4	166·0	9·1	504·4

It will be seen that in 1880 both fevers were unusually prevalent in most parts of the peninsula; but in 1884, while the rate of enteric fever admissions was everywhere excessively high, the malarial fever admission-rate, on the other hand, was everywhere low. In Madras the malarial admission-rate that year was close on its minimum, while that of enteric fever was more than three times as high as in 1880, when malarial fever was so prevalent. The malarial admission-rate of Bombay in 1882 was considerably lower than in the previous year, but the ratio of enteric fever admissions was just the reverse. In short, so far as can be judged from the above table,

there is as little correspondence between the annual prevalence of the two diseases as there is between their annual mortality.

4. The monthly distribution of malarial and enteric fever shows considerable differences that should be weighed by those that advocate the malarious character of Indian typhoid. We shall first give the distribution of 100 cases of enteric fever as compared with 100 cases of fevers other than enteric—that is, of intermittent, remittent, and continued fevers, which are generally regarded as due to malaria. The following table, given by Marston, is for the army of India as a whole, and for the period 1874–78:[1]—

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Enteric Fever, .	5·13	3·75	4·33	9·39	14·73	10·54	9·17	9·89	13·86	8·74	4·69	5·78
Malarial Fever, .	4·29	3·60	4·03	5·56	7·50	8·20	8·88	9·93	12·60	15·06	12·01	8·34

From this table it will be seen that, taking India as a whole, enteric fever has two maximal periods, the first and principal falling on May, and the second on September. Malarial fever, on the other hand, attains its maximum in October. No less than 39·67 per cent. of the total cases of malarial fever occur in the three months, September, October, and November, against 27·29 per cent. of enteric fever. The three months, April, May, and June, furnish 34·66 per cent. of the annual number of cases of enteric fever, and only 21·26 per cent. of the total of the annual cases observed of malarial fever.

But as those who maintain the malarious nature of the Indian enteric consider it to be allied to the remittent and continued forms of the malarial infection rather than to the intermittent, which, furnishing the largest number of cases, determines the monthly distribution in the above table, it will be necessary to compare the distribution of enteric fever with the remittent and continued forms of malarial infection.

Now, we have already shown that enteric fever does not observe the same period of prevalence all over India. Referring to the tables already given, it will be seen that in Bengal generally, from Assam in the east to Afghanistan on the west, enteric fever attains its maximum in May, with a more or less pronounced secondary rise in September; while in Central India, Bombay, and Madras, the third quarter is that in which the maximum is attained. We may take the Punjab and Bombay as illustrating the two distribution periods in India.

Both of the following tables deal with admissions; but it will be observed that, whereas the figures for the Punjab give the monthly distribution per cent. of the cases, those for Bombay show the monthly admissions among the troops per 1000 of strength. This, although detracting from the symmetry of the tables, in no way

[1] *Army Medical Report*, 1879.

affects their value as illustrating the monthly prevalence of enteric fever, and of the remittent and continued forms of malarial fever in India. Both tables refer to the same period of ten years.[1]

MONTHLY PERCENTAGE OF ADMISSIONS FROM REMITTENT AND CONTINUED FEVERS AND FROM ENTERIC FEVER IN THE PUNJAB AMONG EUROPEAN TROOPS, 1870–79.

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Remittent and Continued Fevers,	1·3	1·4	2·0	6·1	13·8	12·3	13·4	13·1	16·3	12·6	5·2	2·5
Enteric Fever,	4·0	4·0	4·0	8·0	16·0	18·0	12·0	8·0	10·0	8·0	4·0	4·0

MONTHLY ADMISSION-RATES PER 1000 OF STRENGTH FROM REMITTENT AND CONTINUED FEVERS AND FROM ENTERIC FEVER AMONG THE TROOPS IN BOMBAY PRESIDENCY, 1870–79.

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Remittent and Continued Fevers,	4·1	4·6	8·4	11·0	12·0	13·3	12·0	13·3	15·2	16·7	12·0	8·3
Enteric Fever,	0·2	0·2	0·2	0·3	0·2	0·1	0·1	0·3	0·6	0·4	0·2	0·2

It will be seen that remittent and continued fevers have practically the same period of prevalence all over India, the maximum being attained a month earlier in the Punjab than in Bombay; whereas enteric fever, as we have already said, has different maximal periods in the two regions. The monthly distribution of the two diseases is thus very different. Enteric fever is apparently less a seasonal disease than malarial fever. Malarial fever almost disappears from the list of diseases in January, February, and March in the Punjab, but a considerable number of cases of enteric fever is met with at all seasons.

The facts which we have been considering, relating to the pathological and clinical characters of the disease to its geographical, topographical, and seasonal distribution in India, are not, it must be confessed, entirely conclusive as to the nature of Indian typhoid. They are, many of them, of a nature that may bear more than one interpretation; but they seem, upon the whole, to favour the opinion, supported by the history of the disease in other parts of the world, that enteric fever is a disease dependent on an infective principle different from that which gives rise either to intermittent or remittent fevers. It has been proved beyond all doubt that enteric fever in India may be met with in regions remote from all human settlement or intercourse; it can seldom be traced to infection from a previous case, nor is it usually possible to connect it with any marked sanitary defects; and at times it assumes an epidemic extension over the whole, or a large part, of the peninsula. It is a seasonal disease, although in a less degree than malaria, and its period of maximum prevalence differs in different regions of India. These are facts which seem to be satisfactorily proved, and they point to its miasmatic character. It does not have the same topographical or seasonal distribution as malaria, and its pathological lesions are distinctly different,—facts,

[1] *S.M.I.* 1882–83.

again, which seem to show that, if miasmatic, it is not malarious. In India two forms of enteric fever are met with: the one similar in etiology and clinical history to that most frequently seen in Europe, traceable to infection from a previous case, following the typical febrile evolution, marked by the characteristic eruption, and accompanied with diarrhœa; the other of miasmatic origin, often beginning as a remittent or intermittent, the rose-coloured spots being the exception rather than the rule, and constipation quite as common as diarrhœa. The pathological lesions are the same in both, and even the symptoms and course of the disease in the two are in the main alike. The first type of the disease is that which is most familiar in the hospitals of large cities in Europe and America; the second form is widely diffused over large regions of the globe, being met with in Africa, the United States, and Brazil, presenting everywhere the same features as those which have perplexed Indian physicians, leading them to regard it as the final stage in the more prolonged forms of malarial fever. We are inclined to believe that the infective principle is essentially the same in both. In the miasmatic-contagious form the germ is modified by cultivation in the body of the subject suffering from the disease; but the same germ is capable of growth in the soil or other nutrient medium, and is not necessarily derived from a germ given off from a previous case. It is probably true, as Marston suggests, "that a prolonged residence in the country confers an immunity similar to that observed in opium or arsenic eating."[1] The disease being pretty universally distributed, the native is acted on by attenuated doses of the infective principle until a partial immunity is established. The fact, therefore, that the adult natives are comparatively exempt from enteric fever, so far from indicating that the cause of the disease is rare in India, is rather to be regarded as a proof of its prevalence.

Typhus Fever.—We meet with accounts of typhus by various authors as occurring in different parts of India; but some of these refer to relapsing fever, and others to the Indian plague. There is at present no evidence of the existence of this disease in India.

Relapsing Fever.—The first writer, so far as I know, who gave a correct description of relapsing fever in India was Lyell. He observed an epidemy of the disease in the Yusufzie valley, on the North-West Frontier, in 1852–53.[2] Chevers, however, points out that Jamieson had recorded an outbreak of fever which can be identified with this disease, which ravaged Upper India in 1816. Numerous epidemies of the same nature have been observed during the last thirty years in Upper India, Central India, and Bombay, but none of these have hitherto been observed in Lower Bengal. Some writers

[1] *Army Medical Report*, 1880. [2] *Ind. Ann. Med. Science*, Oct. 1854.

have supposed that the Burdwan fever was of this nature; but relapsing fever is so well known in India that it could scarcely have been overlooked by so many observers, during the comparatively long period that the Burdwan fever lasted, if it had formed an important element in that outbreak.

Influenza.—Although we are quite justified in believing that epidemies of influenza have frequently occurred in the past, of which no record remains, the medical history of the nineteenth century goes far to prove that few regions are less exposed to these visitations than the Indian peninsula. Hirsch records only two epidemic outbreaks. The first of these occurred in 1832, when it prevailed in Indore, Meerut, and other places in April, and in December of the same year at Bangalore. The second occurred at Calcutta in 1834, in the months of January to April.[1] In 1890 influenza again made its appearance in various parts of India. That the disease is both rare and mild in India, may be inferred from the statement of Mackinnon: "In no Indian authors that I know of is influenza described; and, with some knowledge of army returns, I venture to say they will equally show that epidemic influenza is here unknown."[2] This, as we have seen, is not strictly accurate.

Dengue.—India may be regarded as one of the headquarters of dengue, where it was observed, as far back as 1780, on the Coromandel coast. Since that time it has repeatedly appeared in local outbreaks; and three extensive epidemies, involving the whole country, have been noticed. In 1824 and 1825 dengue prevailed over a great part of the peninsula, dying out during the cold season. Less extensive outbreaks occurred in 1836 and in 1844 at Calcutta, and in 1847 at Cawnpore. In 1853–54 it was widely epidemic in Upper India and Burma, and again in 1871–73. On the latter occasion it appeared in the month of November at Bombay and Calcutta, in January at Cananore and Calicut, and in February at Madras; but in all districts it reached its height in the summer months of 1872 and 1873. It is said to have been observed in Dacca and in the city of Madras for the first time in 1872.

[1] An epidemic catarrh, or bronchitis, raged in Calcutta in 1824, and still more severely, amongst the European children, in the months of June, July, and August 1828. It is not quite certain whether the native children suffered in that year. But the epidemy was not limited to Calcutta, but extended over a considerable part of Lower Bengal. At Burdwan it is recorded that the adults also suffered from the complaint, which in them was accompanied by a troublesome ophthalmia (Chevers). If this was true epidemic influenza, it appears to have been limited to this Province, for it must be remarked that influenza is not reported as having been prevalent in any other part of the world in that year.

[2] *Ind. Ann. Med. Science*, Oct. 1855.

CHAPTER XVI.

PLAGUE, DYSENTERY, AND DIARRHŒA.

Plague.—This century has witnessed numerous epidemic outbreaks of the plague in different parts of India. The following are the years and places in which the epidemies I have found mentioned occurred:—

1815–21.	Gujerât, Kutch, Kattiwar.
1823.	Garhwál, Budaun.
1828–29.	Hansi.
1832.	Pesháwar.
1836–38.	Pali, Meywar, Malwa, Garhwál, Bareilly.
1846–47.	Kumaun.
1852 and 1876.	Garhwál.
1884.	Kumaun.

The frequency with which the disease has reappeared in the mountainous regions along the southern slopes of the Himalayas, makes it probable that the disease is endemic in that region. The Mahamurri, as it is called, is by many supposed to be typhus of a malignant type, and is ascribed to the over-crowded, unventilated huts in which the natives live,—the compounds, and even the huts themselves, being sometimes occupied by animals. Buboes are always a pathognomonic sign of the Mahamurri, which unquestionably stamps its nature as true plague. In the Gujerât and Pali epidemies the disease assumed two forms, the bubonic and the hæmorrhagic. In the latter form buboes are absent, the leading symptoms being fever, delirium, and hæmorrhage from the lungs. The origin of the first outbreak is thus given by M'Adam:—"The origin of the disease, which has for some time raged in Wagur and the Mucha Kanta, is involved in obscurity. It appears to have been first noticed at Kuntakote or its neighbourhood in May 1815; thence it spread to Munsuvia, Chitore, Adooee, and Wandia, all towns in Wagur, and in all of which it committed great ravages during the months of January, February, and March" (*Ind. Annals*, 1854).

In India, plague is not restricted to any particular season.

Dysentery and Diarrhœa.—Dysentery and diarrhœa are included in the mortality returns of the civil population, under the general heading "Bowel complaints," so that the extent to which each of these diseases prevails cannot be ascertained.

The average number of deaths registered from bowel complaints among the civil population of India from 1881–84 was 268,904. Assuming that the population furnishing returns averaged 206,000,000, the death-rate from this class of diseases would be 1·30 per 1000, or 1300 per million, as against the English average of 652 per million for dysentery and diarrhœa. The returns, however, undoubtedly understate the prevalence of these diseases in some of the Provinces, especially in Lower Bengal.

The combined dysentery and diarrhœa death-rate of the Indo-European army, for the period 1870–79, was 1·60 per 1000; that of the native army, from 1867 to 1876, was 2·01 per 1000. In the jails the deaths from these two diseases, from 1872 to 1881, averaged 19·22 per 1000 of strength. All this goes to prove that bowel complaints occupy a prominent place among the endemic diseases of India. In the Presidency of Bengal their geographical distribution can be roughly determined by the average admission and death rates from bowel complaints in the different divisions occupied by the native troops. The period we give is 1881–84:—

Bengal and Assam.		Gangetic Provinces.		Rohilkund and Meerut.		Agra and Central India.		Punjab.	
Admission-rate.	Death-rate.	Admission-rate.	Death-rate.	Admission-rate.	Death-rate.	Admission-rate.	Death-rate.	Admission-rate.	Death-rate.
198 0	3·59	61·0	0·70	55·0	0·98	46·0	·52	63·0	1·43

Dysentery and diarrhœa are seen to be most common in Lower Bengal and Assam. From other sources we learn that Assam suffers even more than Bengal, the districts of Sibságar and Lakhimpur, in the north-east of the Brahmapootra valley, being endemic seats of both diseases. The average mortality in Calcutta from bowel complaints, chiefly diarrhœa and dysentery, for the four years 1881–84, was 3·14 per 1000. As we pass from Lower Bengal to the north-west, bowel complaints become less prevalent and fatal; but when we reach the Punjab a marked increase in the death-rate is again observed, although it still falls far short of that of Bengal and Assam.

The relative prevalence of the two diseases from Assam to Afghanistan, as indicated by the admission-rates among the native troops per 1000 of strength, may also be gathered from the following figures, referring to stations arranged from east to north-west for the period 1867–76:—

	Dibrugarh.	Barrackpore.	Lucknow.	Bareilly.	Ferozepore.	Jhelum.	Peshàwar.
Dysentery, .	111·2	112·1	45·5	23·7	34·3	61 6	97·7
Diarrhœa, .	76·1	69·8	39·4	14·2	27·1	20·0	68·5

The following was the admission-rate of the European troops, for the several Provinces, for the ten years 1870–79:—

	Bengal Proper.	Gangetic Provinces.	Meerut and Rohilkund.	Agra and Central India.	Punjab.	Malwa, Sind, Rajputana, and Aden.	Deccan and Nagpur.	Southern India.
Dysentery,	48·0	36·8	36 4	26·6	28·1	26·9	51 3	59 6
Diarrhœa,	47·5	67·5	63·2	48·4	61·0	62·4	66·1	..

The death-rate from bowel complaints is notably high in Simla and other hill districts. In Simla, the death-rate from this class of diseases among the civil population of the district, for the five years ending 1885, was 2·69, against the provincial ratio of 0·89 per 1000. Simla, Kasauli, Chakrata, Subathoo, and Dugshai suffer from a peculiar form of diarrhœa known as "hill diarrhœa." It is characterised by a preliminary stage of irritative diarrhœa, with yellow stools, followed, after twenty-four or forty-eight hours, by a persistent diarrhœa, with light or slate-coloured frothy motions of the consistence of gruel, accompanied by flatulent distension, and ending in anæmia and debility. Some have considered it to be identical with sprue, to which, indeed, it bears a marked resemblance. Hill diarrhœa is, however, much more common in men than in women, while this is not observed to be the case as regards *sprue*. Of 127 cases referred to by Wardrop, 119 occurred in men, 7 in women, and only 1 in a child. Besides, the aphthous ulceration of the tongue and mouth so common in sprue is rarely seen in hill diarrhœa.[1]

In many parts of the Central Provinces and Berar, especially the latter, bowel complaints are excessively common among the natives. In the former, the district of Sambulpur, in the latter, that of Akola, claim pre-eminence. In Sambulpur the frequency of these diseases is ascribed to impure tank-water, and is generally associated with worms. It is remarkable, however, that in both of these Provinces there are districts which, if the mortality returns are even moderately correct, are little liable to this class of disorders, but which, on the contrary, show a high fever mortality. At Kamptee, in the Central Provinces (see p. 388), diarrhœa and dysentery give rise to many admissions and a considerable mortality.

The Presidency of Madras uniformly returns a high admission-rate, and usually a high death-rate from dysentery among the European troops, compared with those of the other Presidencies. From 1870–79 the ratio of admissions and deaths per 1000 from dysentery, in the three Commands, was as follows:—

Bengal.		Madras.		Bombay.	
Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.
33·0	1·37	77·0	2·32	28·0	0·98

The different regions of the Presidency suffer unequally. Along the east coast, from the Godavery southwards, dysentery and diarrhœa are widely prevalent. The city of Madras itself shows a high death-rate from bowel complaints, which in the three years 1881–83 averaged 5·4 per 1000 of the civil population—a proportion much higher than that either of Calcutta or Bombay. On the west coast

[1] Wardrop, *Army Med. Rep.* 1886; see also Grant, *Ind. Ann. Med. Sc.* Oct. 1853.

these diseases are less frequent. The plains of Trichinopoly and of Malliaporam may also be included among the less severely affected districts. On the table-land, dysentery and diarrhœa hold a prominent place; but in many instances their prevalence is apparently due to local conditions, and not primarily dependent on climate influences. Secunderabad was formerly ravaged by dysentery, but in recent years sanitation has affected a considerable reduction in the mortality from this cause.

In Bombay, dysentery and diarrhœa are less generally diffused than in Bengal and Madras. The city of Bombay had an average death-rate, for the four years 1881–84, of 2·25 for diarrhœa and dysentery, of which 1·46 was caused by diarrhœa and 0·79 by dysentery. It has thus the lowest death-rate from these causes of the three Presidency towns. Thana, Kolaba, Broach, Panch Mahals, Ahmedabad, Gujerât, and Sind, especially the last, enjoy a marked immunity from these diseases. At Deesa, in Palanpur, according to Hanbury, "dysentery is an affection of very rare occurrence,"[1] although malarial fever is here excessively prevalent. The table-land adjoining Berar, and the Central Provinces, suffer to a greater extent than those districts which we have enumerated. Poona and Kaládgi are exceptions to this rule. Khándesh, Belgaum, and Dhárwár are the districts in this region where diarrhœa and dysentery are most prevalent.

Dysentery is most fatal amongst the European troops stationed in Bengal and Bombay in the third or fourth quarters, and in Madras the third quarter is more uniformly that in which the largest number of deaths from dysentery is recorded.

The monthly distribution of deaths from dysentery in the native army of Bengal, for the period 1864–73, was as follows:—

Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11·9	7·9	8·3	4·1	4·4	5·2	6·7	6·7	6·3	10·0	12·3	15·2

Dysentery, as it appears among the native troops, is not in India a disease of the hot season, but, like intermittent fever, is most fatal when the temperature has fallen, and after the rains have subsided. Malaria predisposes to, and undoubtedly aggravates, dysentery; and although there are good reasons for rejecting the theory put forward by many observers, that dysentery and intermittent fever are due to the same miasm, it must be admitted that the former is a frequent and always a grave complication of the latter.

While dysentery, taking the Presidency as a whole, is most fatal in the fourth quarter, considerable differences are observed as to the months and seasons in which it prevails in particular localities. At Dibrugarh, for example, which includes the outposts of Assam,

[1] *Army Medical Report*, 1859.

the greatest number of admissions among the native troops (1867–76) occurs in the months of May, June, and July; but at most stations autumn and winter are the seasons when the disease is most common. To illustrate the differences in the monthly prevalence of the disease in various regions of the Presidency, we give the following table, showing the monthly percentage of admissions among the native troops for the period 1867–76, and the number of cases on which the percentages are calculated:—

	Number of Cases.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Dibrugurh,	873	6·9	7·2	5·0	9·5	11·7	11·4	10·9	8·5	7·6	8·2	6·5	6·0
Barrackpore,	949	13·9	7·3	7·4	7·9	6·3	4·8	6·9	7·7	8·2	10·1	8·8	9·7
Lucknow, .	710	6·6	7·7	10·9	8·6	6·5	6·5	4·0	9·7	9·6	9·4	12·7	7·8
Jhelum, .	729	3·6	2 2	3·8	9·6	8·1	6 2	7·3	11 2	10 8	11·8	13 2	12·8
Dera Gházi Khan, .	893	6·2	3·6	3·7	6·3	5·2	4·6	2·7	4·9	18·5	21·8	15·1	7·4

It will be observed that in Assam, Bengal, and the North-West Provinces, where the difference between the seasons is less marked, the admission-rate for dysentery is more equally distributed over the year than in the north-west of the Punjab, where the climatic extremes are more accentuated.[1]

Diarrhœa is in most countries peculiarly a disease of the warmest months, and its prevalence in different years varies with the temperature of the summer season; but this is not the case in India. So far as the native troops are concerned, its monthly prevalence follows pretty closely that of dysentery. At Dibrugarh, diarrhœa attains its maximum in May, June, and July; at Barrackpore the maximum occurs in November, December, and January; at Lucknow there are two maxima, the first in March and April, the second in August and September; while the months of September, October, and November furnish the greatest number of admissions at Jhelum, Pesháwar, and Dera Gházi Khan.

Nor does it appear that, amongst the civil population, the warm months are those during which "bowel diseases" are the most fatal. In the Punjab, this class of diseases are most fatal in September and October; in Madras, in December and January; in Berar, where bowel complaints are so fatal, the greatest mortality occurs in the months of August, September, and October. As bowel complaints include both diarrhœa and dysentery, it is impossible to trace their individual prevalence in the different months; but in regard to the native troops stationed at Barrackpore, Lucknow, Ferozepore, Dera Gházi Khan, and Jhelum, the months of June and July, when the summer heat is most intense, are the months when diarrhœa is at its minimum, or is at least comparatively rare.

[1] In Bombay the maximum of admissions for dysentery into the General Hospital (1846–56) took place in December and January, a second maximum occurring in July.

CHAPTER XVII.

CHOLERA.

THE period when cholera first appeared in India, and its original habitat, are alike unknown. Shortly after intercourse was established between Western Europe and Hindostan, we meet with notices of destructive epidemies of the disease on the west coast of the peninsula. Thus, cholera is stated to have raged with great intensity in the vicinity of Calicut in 1503, and in 1543 at Goa. In the year 1563, Garçia D'Orta described cholera, in the earliest European work on Indian medicine, as a disease then well known; but before, and long after his time, the records of its epidemic outbreaks are very imperfect, and refer only to the limited localities in which Europeans were then interested through commerce or war; and such outbreaks are noticed incidentally as they affected these operations, and consequently their history is neither fully nor continuously given. In the seventeenth century, especially in its latter half, there is strong reason to believe that cholera was epidemic in Marwar and Mewar, and at Goa and Surat.[1] In the eighteenth century, accounts of severe epidemies of cholera come chiefly from the Madras coast.[2] Whether the scene actually changed from the west to the east coasts, or that the records from the west coast in the eighteenth century are incomplete, cannot now be ascertained; but it is certain that severe epidemies occurred along the Madras coast from 1756 to 1792, at a time when cholera attracted little attention either in Bengal, in the north-east, or along the shores of the Arabian Sea. After a period of comparative quiescence, extending over a quarter of a century, from 1790 to 1815, the disease reappeared in 1816, and

[1] Macpherson, *Annals of Cholera*, Lond. 1884.

[2] Cholera was epidemic in Arcot, Vellore, and the surrounding country in 1756, 1769–71, 1787–89. In Madras it was epidemic in 1774, and along the Coromandel coast in 1776–78; at Tranquebar in 1780, and at Gangam in 1781. In 1769 cholera was epidemic at Pondicherry. The first reference to cholera in Bengal goes back to the year 1703; and it seems also to have prevailed to some extent in 1781, and on this occasion it penetrated into Assam; but in neither locality does it appear to have been persistent nor fatal.

this time its starting-point was in Bengal, whence it spread in the succeeding years, up to 1823, not only over India, but over the whole of Asia and a part of the Indian Ocean, from Syria to Japan, and from Mauritius to Astrakhan. Since that date, cholera has never been absent from India; and although it seldom ranks as one of the principal causes of death, no year passes in which it fails to contribute its share, great or small, to the death-rate of some of the governments.

We must first endeavour to form some idea of the mortality from cholera, in recent years, in the different parts of India, and for this purpose I give the subjoined table :—

Table showing the Average Annual Death-rate from Cholera in the various Governments of India.

Province.	Period.	Average death-rate per 1000.
Assam, ...	1880–86 (7 years)	2·98
Bengal, ...	1872–82 (11 ,,)	1·57
North-West Provinces, . North-West Provinces and Oudh,	1865–76 1872–82 } (18 ,,)	1·04
Punjab, ...	1865–82 (18 ,,)	0·35
Central Provinces, . .	1872–87 (16 ,,)	1·55
Berar, ...	1876–85 (10 ,,)	2·90
Madras,[1]	1866–83 (18 ,,)	2·12
Bombay (excluding Sind), .	1866–81 (16 ,,)	1·31
Sind, ...	1875–84	0·26

For the period 1880–84 the mortality was distributed as follows: —urban, 3·32; rural, 1·52; and for the entire provinces, 1·59.

If we take the death-rate of the native army as an index of the mortality caused by cholera in the three Presidencies of India, we shall have the following results :—

Bengal, 1877–84, Death-rate per 1000.	Madras, 1877–84, Death-rate per 1000.	Bombay, 1877–84, Death-rate per 1000.
1·21	2·09	1·32

In Bengal, the incidence of the cholera mortality per 1000, according to military divisions, for the four years 1881–84, was as follows :—

Lower Bengal and Assam.	Gangetic Provinces.	Rohilkund and Meerut.	Agra and Central India.	Punjab.
1·95	1·01	0·44	0·26	0·19

The incidence of cholera on the Indo-European army will be given in the sequel. The returns referring to the civil population show, for the years with which they deal, that cholera causes the greatest mortality in Assam, Berar, and Madras; while Sind, the Punjab, and North-West Provinces suffer least. It is to be noted

[1] In Madras, the mean number of deaths annually during this period is given at 60,096, and I have assumed the mean population for which returns were returned at 28,289,899. For the period 1884–89, the sanitary commissioner gives the ratio at 1·6 per 1000.

that Lower Bengal, which is looked upon as peculiarly the endemic abode of cholera, stands fourth in order as regards its cholera death-rate. The military returns agree, upon the whole, with the statistics of the civil population. Madras, for the period 1877–84, has a cholera death-rate of 2·09; Bombay takes the second place with 1·37; while Bengal stands last with a mortality of 1·21 per 1000. The troops stationed in the North-West Provinces, especially in Rohilkund and Meerut, and in the Punjab, enjoy, like the civil population of these regions, a comparative immunity from the disease.

But if the various regions of India differ widely from each other as regards the average cholera mortality which they exhibit, they differ no less in respect to the continuity or otherwise of its manifestations.

In Assam and Bengal, and in the south-eastern districts of the North-West Provinces, no year, and no month of any year, passes without cholera making a considerable number of victims. In the Punjab, the Central Provinces, Berar, the northern and western districts of the North-West Provinces and Oudh, in Sind, Rajputana, Coorg, Hyderabad, and Mysore, there are certain years when the disease is either entirely absent or practically so; and, what is equally noteworthy, the disease in these regions is limited to certain months of the year. In the case of Madras and Bombay, again, there are certain years when the mortality is low, but no year from 1866 to 1887 has passed without a certain number of cholera deaths being registered in each of these governments. The years 1873, 1874, and 1880 were years when the cholera deaths in Madras sunk to a minimum so low as to prove that cholera in these years could have been present in a few localities only. It would appear, however, that from some districts of Madras cholera is never absent. In Tanjore, for example, we are told that "cholera has been prevalent ever since registration has been introduced."[1] There is reason to believe that in an area extending from Pondicherry to Tinnevelly along the coast, and inland to Salem, Trichinopoly, and Madura, cholera is seldom absent for any length of time. In that part of the Bombay Presidency situated on the table-land of the Deccan, cholera, although frequently prevalent, is occasionally absent. In the Northern Deccan no cholera deaths were registered in 1873, and only two in 1874. Again, in the year 1876 cholera furnished a death-rate of 0·04 per 1000 living. In the Southern Deccan, no deaths occurred in 1879; in 1874, 1 death; and in 1880, 18 deaths. In these districts the disease is limited, as a rule, to the eight months from March to October, and often to the four months, May, June,

[1] *S.M.I.* vol. xviii. p. 163.

July, and August. In Sind, cholera is only an occasional summer visitor. In the sixteen years 1866–81 cholera was absent for five years in succession, viz. 1870–74, again in 1877 and 1880–81.

In the Konkan and Gujerât divisions, no year between 1866 and 1881 passed without cholera deaths having been registered. The city of Bombay has never escaped the disease during the thirty-four years included in the period 1848–84. It thus appears that there are, both in Madras and Bombay, areas in which cholera has, as it were, its home; and other districts to which it extends only as an epidemic in certain years. But there is this difference between Bombay and Madras on the one hand, and the Central Provinces, Berar, and the Punjab on the other, that, in the former, the years of extensive epidemic prevalence are more frequent than in the latter.

The annual mortality from cholera in each of the eight principal governments of India, will be seen from the subjoined table, and its monthly distribution from a table to be afterwards given.

TABLE SHOWING FOR A SERIES OF YEARS THE REGISTERED MORTALITY FROM CHOLERA PER 1000 LIVING IN EIGHT GOVERNMENTS OF INDIA.

Years.	Assam.	Bengal.	N.-W. Provinces.[1]	Punjab.	Central Provinces.	Berar.	Bombay.	Madras.
1866, .	...	...	0·27	0·06	...	...	1·85	8·20
1867, .	...	...	1·95	2·45	...	...	0·32	1·35
1868, .	...	...	–0·64	–0·03	...	–2·80	–0·50	–0·32
1869, .	...	+	3·06	0·53	10·50	5·20	3·77	0·85
1870, .	...	+	0·44	0·03	0·00	0·22	0·20	2·31
1871, .	...	–	–0·11	–0·02	–0·00	–0·20	†0·41	–0·72
1872, .	...	0·56	1·64	0·50	0·21	0·70	1·03	0·44
1873, .	...	0·88	0·49	0·01	0·04	0·00	0·02	0·03
1874, .	...	–0·86	–0·20	–0·004	–0·00	–0·00	–0·01	–0·001
1875, .	...	1·63	1·33	0·36	1·98	10·20	2·93	3·12
1876, .	...	2·97	0·85	0·33	2·71	1·20	1·98	5·07
1877, .	...	–2·34	–0·74	0·001	–0·46	–0·40	†3·54	†12·24
1878, .	...	1·43	0·52	0·01	5·33	15·60	2·89	1·62
1879, .	...	2·06	0·84	1·49	3·77	0·10	0·43	0·46
1880, .	–0·74	–0·59	†1·67	–0·001	–0·04	–0·00	–0·04	–0·02
1881, .	1·12	1·19	0·58	0·30	1·04	1·30	1·01	0·33
1882, .	4·68	2·75	2·02	0·002	1·36	1·40	0·48	0·82
1883, .	–3·30	–1·36	–0·41	†0·01	†1·84	†10·60	†2·31	†1·27
1884, .	4·92	2·03	0·68	0·03	0·02	0·03	0·84	2·70
1885, .	1·71	2·62	1·40	0·10	2·48	1·40	2·27	2·00
1886, .	†4·47	–1·78	–0·78	–0·006	–1·89	–0·40	–0·01	–0·44
1887, .	1·75	2·60	4·50	0·47	1·43	5·50	1·56	1·02
1888, .	2·14	1·68	0·42	...	0·10	...	2·23	...

[1] North-West Provinces 1866 to 1877, and the North-West Provinces and Oudh 1878 and after.

+ The sign – indicates the triennial minimum; the sign † is placed against the period which, according to the general rule, should have been the minimum, when the minimum was not attained. I have not been able to ascertain the ratio of deaths in Bengal for the years 1869, 1870, and 1871, but it appears that cholera was prevalent during the two former years, and less so in 1871. This is indicated by the signs + and – placed against these years.

It will be observed that those regions where cholera is constantly present are by no means those in which it occasions the greatest mortality. Nor is the reverse always the case. In Assam, cholera prevails more or less in every month, and every year, and here the cholera death-rate is the highest of any part of India; while in Berar, where one, two, or even three years may pass without any cholera deaths occurring, the mortality, on an average of years, is higher than in Bengal, which is never free from the disease.

The same thing is noticed in the North-West Provinces. In the eastern districts of Mirzapur, Benares, and Azamgarh, adjoining Lower Bengal, each of the sixteen years 1870–85 was charged with cholera deaths. The neighbouring districts of Gázipur and Gorakhpur escaped for only one year during that period; and it is seldom absent from the region to the south-east of a line stretching from Gonda through Lucknow to Cawnpore, including Hamirpur, Banda, and Fatepur, to the west of the Ganges. To the north and west of this line, on the other hand, cholera may be absent for two or even for three years in succession, and when it does appear, it is limited to certain months of the year. Within this north-western area of occasional cholera prevalence, the three districts of Muzaffarnagar, Saháranpur, and Meerut are characterised by their remarkably low cholera death-rates, the annual average during the period mentioned having been 0·10, 0·21, and 0·14 respectively. Other districts, again, in the same area, such as Sitapur, Kheri, and Kumaun, although only occasionally visited by the disease, present averages for the sixteen years of 2·45, 1·31, and 1·53 respectively. The mortality in any area is thus not in relation to the constancy or rarity of the disease in such area.

We have seen that there are certain areas in India in which cholera is constantly present, and others from which it is occasionally absent for one or more years; that, where it holds permanent sway, every month of the year is more or less charged with deaths, while in those regions where it is not constantly present, its visits are generally limited to certain months. In the former class of areas, cholera is said to be endemic, in the other class of areas it is epidemic.

If we inquire into the manner in which the disease occurs in endemic areas, we shall find that it is not constantly present in any one spot, but breaks out here and there in more or less severe epidemic explosions, shifting its seat from one village or district to another, and, after a varying interval of quiescence, reappearing in the spot where it had previously prevailed. Nor is it equally prevalent in large endemic areas in different years, for these as well

as non-endemic districts experience epidemic exacerbations. Now, if this be the case, it is evident that no very hard and fast line is to be drawn between endemic and epidemic areas. When the disease within a given region is seldom absent for any length of time from the different districts within that region, and never absent from the region as a whole for many months on end, we need not seek to account for its reappearance by supposing that it has been introduced from without; and thus we look upon the disease as endemic in such a locality.

But where months and years elapse over an extensive region without a single case of cholera occurring, we conclude either that the disease, when it reappears, has been introduced afresh from some other place, or that the cholera cause has been present, but latent, during the interval. Assuming the cholera cause to be Koch's bacillus, which is a facultative parasite capable of maintaining its existence and of multiplying outside the body, the question arises, whether this micro-organism can maintain itself in this manner for intervals of one or two years; for if this be so, we should then have to assure ourselves that the disease has been reintroduced from without in a given area, before we could assert that it was not, in some sense, endemic there. Flügge believes that Koch's bacilli "die in a few days under the conditions normally present in our surroundings;"[1] but he considers it possible that some materials, if kept moist, and in which the comma bacilli are preserved in a state of almost pure cultivation, may continue to act for some weeks as a source of infection; and he instances moist cholera linen tightly packed, moist earth, etc., more especially if the temperature is low.[2] Cunningham found commas to be still present after forty-seven days in a mixture of garden earth and fæces which had been boiled, dried, and heated over a Bunsen flame, before being mixed with tube cultivations of the bacillus; but when no such preparation had been made they did not survive above a few days. All this would seem to show that in ordinary circumstances the comma bacillus has only a weak resisting power. In addition to requiring certain conditions to be fulfilled respecting the reaction of the medium, the temperature and moisture, it is specially liable to succumb to the overgrowth of the more vigorous saprophytes. Were it not for these limitations to their spread, these bacilli, assuming that they are the cause of cholera, would prove a serious menace to humanity; and as it is, it is evident that in India they obtain the conditions necessary to their survival more frequently

[1] Flügge, *Micro-Organisms*, Sydenham Soc., Lond. 1890.
[2] *Scient. Memoirs Med. Officers of the Army of India*, Calcutta 1889.

than experiments in the laboratory would indicate, unless, indeed, we are to suppose that every new outbreak in an endemic area is caused by a reintroduction of the germ from without. It must not be forgotten that we are as yet very imperfectly acquainted with the life-history of the comma bacillus. Whether Hueppe's observations of the formation of resting spores be confirmed or not, we may be sure that the comma bacillus, if it be the real cause of cholera, is capable of surviving in some form, or under some conditions, for longer periods than is at present supposed. The recent outbreak of cholera in Spain warns us not to be too certain as to the length of the period during which the cholera cause may remain dormant in a country. Here, after having been absent for five years, cholera suddenly broke out in 1890 in Valencia, apparently without having been reintroduced, on the digging up of some impure earth, which had probably been contaminated with the cholera organism during the previous epidemy of 1884–85.

The recurrence of cholera in any particular locality in an endemic or epidemic area, after its temporary extinction, may thus be the result either of the reintroduction of the cause from some neighbouring locality where it happens to prevail; or it may be due to a renewal of activity; or a repathogenisation, so to speak, of germs remaining, from a previous outbreak, in the soil of the locality itself.[1] When successive cases of cholera occur in a given area, being communicated from one person to another, or transported from one place to another by continuous transmission from infected persons, whether the mode of transmission be direct or indirect, the disease may be said to be continuously endemic in such area. When, on the other hand, without being reintroduced from without, it starts afresh from the revivification of bacilli, or of resting spores remaining in the soil or other surroundings, the disease may be said to be intermittently endemic. Whether cholera be endemic, in this sense, in those districts which we have spoken of as epidemic areas, can only be ascertained from a consideration of all the circumstances connected with its reappearance in those localities from which it has been for a considerable period absent or latent. The longer it has been absent from a given area, the stronger is the presumption against its endemicity.

The *sources* of cholera infection are—(1) the alvine dejecta of the sick, or objects soiled by them; (2) the exogenous growth

[1] It may hereafter be proved that the cholera germ exists as a harmless micro-organism in certain localities in India, and assumes pathogenic properties from cultivation under exceptional conditions of soil and season. If this were established, many difficulties in connection with its epidemic manifestations would disappear.

of infective organisms in soil, water, fruit, or other nutritive material.

The usual, if not the sole, point by which the *contagium* finds an entrance into the system is the mouth, just as the intestinal canal is the primary seat of infection.

If these views as to the source and point of entrance of the infection be well founded, it will readily be understood that the most common media of infection are articles of food and drink. Whether the breathing air also serves as a vehicle of infection is somewhat doubtful. There is certainly no reason why the germs should not reach the mouth and stomach by this agency, provided they are capable of suspension in the air; but if we admit the possibility of the air acting as the vehicle of infection, we are far from suggesting that such cases are other than exceptional.

Among the articles of food and drink by which the cholera organism is diffused, drinking-water takes the first place. Its influence in speading the disease is proved—(1) by particular instances in which the pollution of wells, tanks, or streams has resulted in outbreaks of cholera in the community using a contaminated supply; (2) by the diminished cholera mortality following the introduction of a pure water-supply into a city.

Macnamara relates an instance in which the accidental pollution of water with cholera excreta was followed by cholera attacking five out of nineteen persons who drank of the water.[1] It is seldom that instances so closely of the nature of an experiment occur, but the cumulative weight of innumerable instances in which there is good reason to connect the specific contamination of water with the spread of cholera is irresistible. A few recent instances must suffice. A severe outbreak of cholera occurred in 1885 in the three villages of Darakhi, Indri, and Sheráli, in the Dera Ismail Khan district of the Punjab, causing, from the 8th to the 20th of November, 262 deaths in a population numbering 1573. The water-supply of the three villages was derived from a shallow tank or pool containing only a few inches of muddy water. A band of cholera-infected Powindahs encamped near to Darakhi, and not only supplied themselves from the common tank, but waded into it in order to fill their *gurrahs*. Cholera broke out in the village immediately after this. Here there is no question of direct contagion, but, as the civil surgeon remarks, "the infection of an excessively bad water-supply sufficiently explains the severity of the outbreak." We shall, in the sequel, relate the circumstances of an outbreak of cholera in the village of Dhilwán, which appears

[1] Macnamara, *Treatise on Asiatic Cholera*, Lond. 1870, p. 197.

clearly to have been diffused by contaminated water. I shall only quote one of the numerous instances reported every year of this mode of diffusion. The Deputy-Commissioner of Nowgong enters in his diary for 4th July 1866 :—

"At Kondoli, cholera has swept off fifty-two coolies, principally Gáros and Lalungs. The outbreak was caused, it is supposed, by a Mikir encampment above the garden close to the small nullah (stream) from which the Gáros drink. The camp had cholera. Hardly any Bengalis got cholera, as they used well water."[1]

Simpson has shown very conclusively that in Calcutta cholera cases are often grouped round certain tanks in such a way as to connect very distinctly the outbreaks with the use of water contaminated with the cholera poison.[2]

But the important *rôle* of water in diffusing cholera is perhaps still better illustrated by the results following the introduction of an improved water-supply into particular towns. In Bombay a great reduction of the cholera mortality has been witnessed since 1865. During the seventeen years (1848–64) the cholera deaths numbered 37,454; in the seventeen years 1865–81 they fell to 11,026. It is not to be supposed that this result is entirely due to an improved water-supply; many other sanitary improvements which have been in progress during this period have doubtless had their influence in reducing the mortality; but there can be no doubt that the introduction of water in pipes from a distance, where there is comparatively little risk of pollution, has been an important element in reducing the cholera death-rate. Nor does it militate at all against this conclusion, that it was observed in 1882 that the epidemy of that year did not fall principally on those who used the sewage-polluted well-water, but rather on the population supplied from the Vehar and Tulsi reservoirs. This only proves that impure and sewage-polluted water, injurious as it may be to health, will not produce cholera unless it contains the specific contagium; and we may go further, and say, that a more impure water may even, in certain circumstances, prove less dangerous as regards the spread of cholera than one less impure, from the presence in the former of organisms that rapidly destroy the specific contagium. All this only proves that water is not the sole source of infection in cholera.[3]

[1] *S. C. R.*, *Assam*, 1886, p. 30. [2] *Ind. Med. Gaz.*, Oct. 1887.

[3] It seems, to say the least, extraordinary that a Special Committee of Inquiry into the History of Cholera in India, 1861-81, reports that water contaminated with cholera discharges and used for drinking purposes "has not been found to produce cholera;" and again, "there is no evidence to show that impure drinking-water has anywhere in this country originated an attack of cholera, and far less developed an epidemic of the disease."—*S. M. I.* vol. xvi. p. 303.

In Calcutta, coincidently with the introduction of a comparatively pure water-supply in 1870, the cholera death-rate fell from an average of 8·5 per 1000 in the quinquennium ending 1870 to one of 2·7 in the quinquennium ending 1875; and has increased again, although not to the former mark, coincidently with an increasing scarcity of water leading to the greater use of tank water. Lahore furnishes another example of the influence of an improved water-supply in reducing the prevalence of cholera. The cholera mortality of that city, for the fourteen years 1868–81, was at the rate of 1·07 per 1000. In the period 1882–87, that is, after the introduction of water from the Ravi, it fell to 0·07 per 1000. That this diminution is due to the water-supply, is proved by the fact that in the Lahore district (excluding the city) the cholera mortality, which was 0·34 in the former series of years, rose in the latter period to 0·43 per 1000. If the second period shows such a marked reduction as regards the city, it is not because the disease was less prevalent in the district in which the city is situated. Cholera has in the same way become almost unknown in the city of Delhi since 1875, when an improved water-supply was introduced.

Milk may also serve as the vehicle for spreading cholera. An interesting example of this in Calcutta is recorded by Simpson, which is equally an instance of the disease being conveyed by water. The drainage of a hut soiled with the cholera dejections of a patient reaches a tank. In this tank there is also washed the soiled clothes of the patient. In a few days the inmates of a house who use the water from this cholera-contaminated tank are affected with cholera. A milkman uses this tank, or one quite near to and only separated from it by porous soil, for the purpose of adulterating his milk. The milk supplied by him to the men on board a vessel in the harbour causes diarrhœa and cholera, with four deaths amongst ten or eleven persons using it.[1] The cases are so numerous in which persons partaking of food in a cholera-infected house contract the disease,—and in some of these there is no ground for suspecting the water-supply,—that one is led to suspect that contaminated food is quite a common source of infection. In how many ways the infective matters may reach articles of food can easily be understood. Soiled hands, articles of dress, utensils accidentally contaminated, or insects, may serve to convey the poison to an article of food, which then may serve as a cultivation substance upon which it may multiply.

Finally, we have to admit the direct transference of the infective material from the soiled hands or clothing to the mouth by un-

[1] *Ind. Med. Gaz.* vol. xxii. p. 141.

conscious movements as a not unfrequent means of its entrance into the system.

Hitherto we have been considering the vehicles by which the contagium of cholera is diffused within an infected area; but what are the agencies by which its epidemic extension is effected? Bryden's view is that cholera is influenced by the monsoon. As Marston puts it, "The cholera cause, having no locomotor power in and by itself, must depend for its movement on a vehicle and an extraneous force, the vehicle being moisture, the force being the wind."[1] It is sufficient to say that cholera does not always and everywhere spread in accordance with the requirements of this theory. The influence of the monsoon on the spread of cholera is, however, none the less real, supplying as it does the necessary moisture to the soil, and, as Macnamara has pointed out, by setting in motion the fleets of boats up the Ganges, by which the disease may be disseminated. The view that cholera is propagated by human intercourse, finds little favour in India. Cunningham says, "The experience of fairs and other gatherings in this country has again and again testified to the truth of the conclusion, that cholera is not carried by persons from one locality to another so as to cause persons, not themselves exposed to the necessary local influences, to become affected by the disease."[2] The representatives of Indian medicine at the Amsterdam Congress gave it as the result of their experience, that cholera is neither contagious nor transportable by persons from one locality to another. In support of these views, it is alleged that hospital attendants do not contract the disease from the patients they nurse; that patients suffering from other affections do not contract cholera in hospitals where they are treated along with cholera patients; that in India the diffusion of cholera has no relation to river traffic, to railways, roads, or to any movements of population;[3] and that the Andaman Islands have escaped the infection, although in regular communication with the mainland, where the disease is never absent.

We are bound to treat with respect the maturely-formed opinions of men who have spent the better part of their lives in India in the study of the disease. But we must ask ourselves whether the facts to which they appeal support the conclusions which they draw from them? We must admit as facts proved beyond dispute, that infected persons arriving in a healthy locality do not always, nor perhaps generally, give rise to an outbreak of cholera in such locality; that when an infected crowd at any of the

[1] "Cholera: its Natural Laws and Progress," *Army Medical Report*, 1878.
[2] *S.M.I.* vol. xv. p. 85. [3] *Ibid.* vol. xvii. p. 142.

great fairs or gatherings sets out in different directions from a given centre, the disease may be propagated in certain directions only and not in others; that districts away from a line of railway, and comparatively difficult of access, may, in some instances, suffer to a greater extent than places having more free communication with infected districts; and finally, that communication between a healthy and an infected port does not necessarily lead to the introduction of the disease into the former.

All this seems to be proved by observations that need not be called in question; but none of these facts, nor any other facts that I have met with, justify the conclusion that human intercourse is not one of the principal means of its diffusion. Every seed sown does not germinate. Conditions of soil and season, of temperature and moisture, and also conditions peculiar to the seed itself,—all go to determine whether it will grow or die. Admitting that the cholera seed is contained in the cholera dejections, it does not follow that cholera will break out wherever the cholera dejecta have been scattered. That it often does so, however, seems to be abundantly proved in the history of the introduction of the disease into countries and continents previously free from it. When we remember that cholera has been four times epidemic in Mauritius, and that on each occasion it broke out shortly after the arrival of vessels from India with persons suffering from cholera on board; that in England the disease appeared, for the first time, at Sunderland in 1831, after the arrival of a ship from Hamburg, then an infected port; that it broke out in Quebec in 1832, four days after the arrival of the *Royalist*, on board of which cholera had existed during the voyage; that it appeared at Staten Island, New York, in 1848, on the arrival there of the vessel named *New York* from Havre, which had lost seven passengers from cholera during the voyage; that, in the same year, it broke out in New Orleans, three days after the arrival of the ship *Swanton*, thirteen of whose passengers had died of cholera during the passage,—if we remember these and hundreds of similar cases that could be cited, it is impossible to doubt that cholera can be carried by persons to a healthy locality. No intelligible explanation of such facts can be given upon any theory that excludes the portability of the disease by human intercourse. Can it seriously be contended that the cholera cause had already invaded Quebec before the arrival there of the cholera-stricken *Royalist*; that it had invaded Staten Island before the arrival of the *New York*; that the outbreak at New Orleans three days after the arrival of the *Swanton* was only a coincidence, and would not have occurred if the cholera cause had not been already there?

Yet, in India, when an epidemy follows the arrival of persons suffering from the disease, it is often assumed that the place had already been under the influence of the cholera cause before their arrival, and that this mysterious influence, and not anything derived from the infected persons, gave rise to the subsequent outbreak. If the disease can be propagated by human agency elsewhere, it would require strong evidence to convince us that it cannot be so propagated in India. The presumption must be, that if persons carry the disease from one locality to another in Europe and America, they can do so in India; and this presumption is, I think, supported by facts. Here is one recent instance out of many that could be adduced, and the facts in this case are stated with precision, and seem unequivocal. Two brothers arrived at the village of Dhilwán, which is situated three miles east of the Kot-Kapura station, on the Rewári and Ferozepore Railway, in the Faridkot territory. They came by the morning train, on the 23rd of April 1885, from Hardwár fair, where the disease had broken out. One of them was ill with cholera. He recovered; but the other, who had washed the soiled clothes of the sick man at one of the two village wells, was seized with cholera and died. A sweeper, who took water from the well trough at the time the clothes was being washed, also took cholera. This was on the 24th. No other case occurred until two days after. On the 27th the disease began to spread, and between that date and the 2nd of May seventy deaths are said to have taken place.[1] Can there be the slightest doubt that cholera was carried to this village by these two persons from Hardwár, and that it was diffused by means of the water-supply? What reasonable grounds are there in this case for believing that the villagers who were attacked with the disease from drinking the contaminated water were exposed to any local influences other than this contaminated water? Nothing in the case makes it probable that the cholera cause had reached Dhilwán before the arrival of the two brothers. Such cases seem to prove that, if human intercourse is not the sole, it is, at least, one of the means by which cholera is transported, and that drinking-water is one of the *media* by which it is diffused.

In the Punjab, local outbreaks are often to be traced to the arrival in a village of a stranger suffering from the disease. Instances of this kind are, indeed, so numerous that the doctrine of coincidence is not available as an explanation of their occurrence. In the year 1886, for example, out of twenty-two affected districts, the introduction of the disease into eleven of them was more or less

[1] *S.C.R.*, Punjab, 1885, p. 8.

clearly traced to importation, and it by no means follows that if importation was not traced in the others, that the disease arose in them *de novo*. The germs of a disease are often introduced without their source being detected. In Berar, again, we meet with many instances of cholera being imported by persons from infected localities into places where the disease at that moment is absent. Thus, to cite a single instance: a limited outbreak of cholera occurred in the village of Sanjapore in 1885. Without quoting in detail the history of this outbreak, the main facts may be gathered from the following sentence in which the civil surgeon concludes his account of the outbreak. "I have stated plain facts, and given no theories. Two men go to different places where cholera is, return, and are attacked, and die of the disease—cholera. The people in their houses are attacked with cholera. No speciality of any kind marks their habits nor their habitations from the other people and their dwellings in the village. The deduction that cholera is propagated by contagion is inevitable."[1] I quote this as an instance of cholera being propagated by human intercourse.

In this province cholera appears to be frequently introduced from Kandesh when the disease is prevalent there, and it is often observed to follow the railway connecting Berar with Násik and Nagpur. Numerous instances, illustrating the introduction of cholera by infected persons into the Central Provinces and the North-West Provinces, could be cited. As regards the latter, no more convincing evidence could be adduced of the influence of human agency than that afforded by the introduction of cholera into Garhwál in 1852. The disease broke out among the labourers on the irrigation works at Bhabur, a strip of forest land which divides the mountains from the plains, and numbers of them died. The panic-stricken labourers fled to their homes in the neighbouring mountains, and cholera broke out among the other inhabitants of the villages, commencing in very many instances in the families of the men who brought the disease with them from below.[2] But the evidence of transportability by human intercourse is not limited to epidemic areas, although obviously it is usually more easily to be traced in localities where the disease only appears at intervals. An instance of its introduction by coolies into a number of tea-gardens in Assam furnishes conclusive evidence that it is as readily propagated by human intercourse in endemic as in epidemic regions. In 1886, a band of 267 coolies left Dhubri on the steamer *Loohit*

[1] *S.C.R.*, Hyderabad Assigned Districts, 1885, p. 25; 1883, p. 12.

[2] Reynolds' *System of Medicine*, vol. i. See also *S.C.R.*, North-Western Provinces, 1884. Appendix 17 A.

on the 1st March. Three cases of cholera occurred amongst them during the voyage. The coolies were distributed among seventeen tea-gardens in various parts of the province. The result was that "six absolutely new outbreaks" of cholera occurred in the gardens to which they were sent, spreading to the old coolies resident on the estates. When these infected bands were introduced, there was no cholera on any of the estates where it subsequently appeared. As these outbreaks occurred, not in one locality, but in six, and as cholera broke out suddenly in these widely-separated districts immediately, or soon after, the introduction of the new-comers, it seems impossible to evade the conclusion that the disease was carried and its germ sown, as it were, in various localities of Assam by different groups of a cholera-infected band. That all the gardens did not suffer only shows that the disease had not infected the whole band, or that the local conditions in some of the gardens were unfavourable to its spread.

No more can I gather from the experience of fairs that cholera is not carried by persons from one locality to another, "so as to cause persons not themselves exposed to the necessary local influences to become affected by the disease." The explanation given of outbreaks of cholera in fairs, and subsequently in villages along the return route, is that "the pilgrims bring the predisposition with them to the fair, and those who do not die at the fair carry the predisposition with them in an augmented degree, and so swell the epidemic mortality by overcrowding and added filth at places where they stay on their way home." This explanation ignores the specific nature of the affection. It assumes that cholera can be caused by overcrowding and filth alone, and apart from any specific cause, provided that the pilgrims bring a *predisposition* with them. How this predisposition on the part of the pilgrims affects the residents along their route is not explained. Stating the case simply, it amounts to this: that filth and overcrowding can produce epidemics of cholera,—a doctrine which is altogether inadmissible. The Juggernaut or Pooree gatherings have frequently been the means of disseminating cholera in all directions; or, to put it in a way that involves no theory, cholera has frequently been observed to dog the footsteps of the pilgrims returning by various routes from the Pooree gatherings at which cholera has been prevalent. Thus we read in the *Bengal Administration Report* for 1873: "Cholera was again associated with the Pooree pilgrims, *travelling with them, and breaking out in places along their line of route, coincidently with their arrival in them.*" In 1881, again, it is stated that cholera "increased in activity at three different periods

coincidently with the influx of pilgrims to the Pooree town, that it spread generally in the district with their dispersion,"[1] and that the pilgrims cause a full half of the deaths from cholera occurring in the district among residents. Macnamara has shown very conclusively that the outbreak of cholera on the 12th April 1867, among the multitudes gathered at Hardwár, was spread all over the country by the returning pilgrims. Much discussion has taken place upon the effects of the great gathering at Allahabad in 1882, where three million of pilgrims were congregated, and where cholera broke out with considerable severity. The fair lasted from the 12th to the 24th of January. Numerous cases occurred at Jubbulpore and other places along their return route. It is shown that deaths were reported as early as the 17th in two districts, at a distance of from 30 to 40 miles from the railway at Jubbulpore, and the inference is drawn that "the occurrence of the disease in the districts along, and for some distance beyond, the Jubbulpore railway about the same time that deaths amongst the pilgrims took place at the railway stations was merely a coincidence."[2] The existence of the disease 40 miles distant, even if proved to have been independent of pilgrim intercourse, affords no evidence that it was not introduced into Jubbulpore and other districts by the pilgrims. It should not be forgotten that pilgrims on their way *to* a fair may spread the disease, if they come from infected districts, as well as on their return; and the very unusual prevalence of the disease at that season in the country traversed by the Allahabad pilgrims, points to the conclusion that they spread the disease, both in going to and in coming from the fair. There is one striking fact to be noticed, viz. that in ordinary years the mortality from cholera in the North-West Provinces gradually rises up to autumn; whereas, in 1882, the normal cholera curve is seen to undergo a singular variation. A comparatively large number of cases occur in February and March, rising to a maximum of 10,595 cases in April, after which the mortality decreased, then rose once more to attain a second maximum in autumn. This looks as if some exceptional cause had been in operation, spreading the seeds of cholera, in these early months, throughout the province. If this cause was not the great pilgrimage, then it is difficult to say what the disturbing element may have been. Allahabad had been free from cholera for some time before the gathering. On the 15th of January, that is, three days after the fair began, the first death was reported, and during the next fortnight of January the deaths from cholera numbered 286. Minor gatherings of the nature of fairs,

[1] *S.M.I.* 1881, p. 198. [2] *S.M.I.* 1881, p. 86.

such as occur everywhere throughout India, as well as marriage and funeral parties, are, in their own measure, equally potent in spreading the disease. Mandhata on the Nerbudda, in Nimar, is such a gathering. Here, in 1885, a severe outbreak of cholera occurred among the pilgrims coming from infected districts, spreading to the resident population of the locality, and followed the pilgrims on their return route,—a large proportion of the villages attacked having been, we are told, "on the main lines of communication leading from Mandhata."[1]

The dissemination of cholera by river and rail is too wide a subject to be satisfactorily treated within the limits to which we are restricted. I must content myself with stating the result of my own study of the subject, which is, that cholera tends to develop along the great routes, whether rail or river, by which persons suffering from the disease usually travel.

No one contends that cholera is readily communicated from the sick to the healthy, like smallpox or typhus. It is probably rarely, if ever, contracted by breathing the air of a room in which cholera patients are treated. Yet I do not find that the immunity of cholera attendants in India is nearly so complete as it is sometimes alleged to be.

Among the European troops, the ratio per 1000 treated for cholera in 1883 was 1·5. In the same year, out of 254 attendants on 82 cholera patients, the number attacked was 4, which gives a ratio of 15·75 per 1000. The native troops in the same year had a strength of 114,830, and we find that 307 cases of cholera, occurring among them, were treated, which gives a ratio of 2·6 admissions per 1000 of strength. Now it appears that 677 persons attended on these 307 patients, of whom 15 contracted the disease, which gives a ratio of 22·15 per 1000. In the jails, again the death-rate in 1883 from cholera was 2·28 per 1000. The admission-rate is not given. The population of the jails for the whole of India, in 1883, was 88,174, and that of Bengal 54,982. The number of cases of cholera treated is given at 308; but it is not quite clear if this refers to India or to Bengal only. If to India, the attacks were in the ratio of 3·49 per 1000; if to Bengal, the ratio would be 5·6 per 1000. We find that of 478 attendants who waited on the 308 cholera patients, 12 were attacked,—a ratio of 25·1 per 1000.[2] These figures show that the attendants on cholera patients among the European troops are about eleven times more

[1] *S.C.R.*, Central Prov. 1885. For an instance of the spread of cholera on a large scale by wedding parties, see *S.C.R.*, Punjab, 1884, pp. 5, 6.

[2] *S.M.I.* vol. xvii. p. 86.

liable to attack than the troops generally; that the attendants on cholera patients among the native soldiers are nearly nine times more liable to contract the disease than those not so engaged; and that, in the prisons, the ratio in which the attendants on cholera patients contract cholera is four or seven times that of the prisoners as a body, according to the basis on which the deaths among the prisoners are estimated.

Such being the facts, I am at a loss to understand the remarks of Dr. Cunningham on these figures. "The results," he says, "fully confirm the statement which has been so frequently made in these reports, that attendance on cholera cases involves no danger greater than that to which all persons residing within a cholera-affected locality, and exposed to the causes which induce cholera, are subject."

We have restricted our remarks to the propagation of cholera by human intercourse; but another mode by which it is doubtless carried from an infected to a non-infected area is by means of *fomites.* The recorded instances of this mode of transmission are by no means so numerous as might have been expected, but I am inclined to think that a considerable proportion of the cases of so-called *spontaneous* outbreaks in non-endemic areas are really owing to this mode of introduction. Here is one example of this kind. In 1882 an outbreak of cholera occurred in Pimpulwady in Bombay. Some cases occurred among wool cleaners and others employed in the same factory. It was ascertained on inquiry that the wool had been brought from Karachi. It had been first sent to Coorla, where the wool cleaners had suffered from cholera, and from Coorla it had been sent to Bombay to be further cleaned.

All these facts seem to prove beyond doubt that cholera is frequently propagated by human intercourse, and that its reintroduction into non-endemic areas is often, perhaps we might say generally, owing to infected persons or things. In a minor number of instances, and in localities specially favourable to the life of the germ, cholera may remain latent for an uncertain period, and then break out afresh.

But however important may be the *rôle* of human intercourse and *fomites* in the diffusion of cholera, it must be recognised that the mode of its transport from one locality or province to another does not explain the spread of cholera in an epidemic manner within endemic areas, or its fitful outbursts and varying prevalence and intensity in epidemic areas. Other conditions and circumstances have to be taken into account in connection with the epidemic

manifestations of the disease. The principal of these are—1. Local conditions; 2. Seasonal influences; 3. Predisposing conditions; 4. Facilities of intercourse; 5. Race proclivities; 6. Epidemic influences.

1. The importance of local conditions in the distribution of cholera in particular areas is so generally recognised, that it will suffice to enumerate a few of the more important of them. *Altitude* is not without its influence on the spread of cholera. In an epidemic form cholera has prevailed at elevations of 6000 feet, as at Kussouli in 1845, and it is said to have attained an elevation of 8000 feet in the year 1838; but as an endemic disease it is limited to altitudes not exceeding 1500 feet. In Assam generally cholera is endemic; but in the Naga Hills, with an elevation of 5000 feet, it only appears at intervals in an epidemic form.

Cholera shows a special predilection for the low-lying and damp parts of a town.[1] Villages situated along the banks of streams, even when these are not used for traffic, are specially liable to attack, and the disease as often extends against as with the current. It appears as if the moisture of the river banks favours the growth of the cholera germ. Imperfectly ventilated and overcrowded districts in towns suffer more than the districts where the population is sparse, where the situation is more airy, and the obstacles to complete ventilation fewer. The rule, that well-cleaned towns are less liable to cholera than those which are dirty, has many exceptions; but when animals are kept in the house or compound, and the floors of the houses are damp as well as dirty, the disease, if, once introduced, spreads rapidly. Dr. Parker observed that at Násik the ground floors are somewhat more frequently attacked than the first storey, and that the second and third storeys fare better than either. Thus, like malaria, cholera may be said to love the ground.

2. The seasonal prevalence of cholera in different parts of India is shown in the following table:—

[1] *S.C.R.*, Central Prov. 1885, p. 22, Seoni; *S.C.R.*, Bombay 1884, pp. 73, 76, Bettigeri and Broach.

Monthly Percentage of Cholera Deaths in various Governments in India.

Months.	Assam, 1882–85.	Bengal, 1877–81.	N.-W. Provinces, 1883–86.	Punjab, 1867–86.	Central Provinces, 1883–87.	Berar, 1868–85.	Bombay,[1] 1874–83.	Madras,[2] 1855–64.
January,	4·8	12·1	0·4	0·3	0·13		2·50	12·0
February,	2·9	6·6	0·1	0·2	0·24	0·36	2·82	13·8
March,	6·1	8·7	0·4	0·4	0·89		4·98	8·6
April,	11·0	14·7	4·2	6·7	2·41	1·60	8·37	4·6
May,	19·7	11·3	6·2	17·7	13·69	3·60	14·86	4·8
June,	17·8	10·0	8·8	16·6	15·59	11·00	18·52	3·8
July,	8·7	8·8	7·9	14·5	23·90	30·80	19·87	9·6
August,	3·6	6·7	17·5	19·3	26·84	36·40	15·23	9·8
September,	2·5	3·2	17·1	15·4	9·15	11·70	5·67	10·8
October,	4·3	2·7	22·4	6·9	4·83	3·00	3·51	9·1
November,	8·5	5·4	9·3	1·6	1·96	0·90	1·87	6·6
December,	10·1	9·2	5·5	0·4	0·36	0·50	1·80	6·4

In Assam, Bengal, and Madras, cholera shows two periods of maximum fatality; in the other provinces there is one maximal period only. The principal maximum in Assam and Bengal falls on the months of April, May, and June, corresponding to the end of the dry and the commencement of the rainy season. The minimum is attained in September or October, when the rains have not ceased, but have very considerably diminished. The second rise takes place in Assam in November and December; in Bengal in December and January, which in both are the driest and coldest months of the year. Thus the first maximum in both provinces corresponds to a high temperature and an increasing rainfall, the second occurs in the cold and dry season. In both, the disease diminishes in prevalence after the heavy rains have made themselves felt. In the Surma valley, in Assam, the cholera maximum is reached in May, the minimum in September and October, when more than half the district is water-logged or submerged. In Madras things go differently. The maximum occurs in the dry and cold months of January and February, which here succeed the heavy rains of October, November, and December. The second maximum in Madras falls on September, which is the month of minimum cholera mortality in Bengal. In the south-eastern districts of the North-West Provinces cholera follows the same seasonal evolution as in Bengal, but in Rohilkand and Meerut the maximum generally occurs later, viz. from August to October. In the Punjab, the Central Provinces, Berar, and Bombay, the cholera, the rainfall, and the temperature maxima correspond in a general way. Thus in Bombay the maximum

[1] Excluding Sind.

[2] Figures given by Cornish, *Med. Times and Gaz.*, March 1868, quoted by Hirsch.

rainfall and maximum cholera mortality fall on July. In the Central Provinces the maximum rainfall is in July and August, and these are also the months charged with the heaviest cholera death-rate. In the Punjab, cholera makes its appearance in April, when the rainfall is still scanty, and it attains a high degree of prevalence in May, before the heavy rains have begun to fall, attaining its maximum in August, when the rains are still plentiful, but beginning to diminish.

The maximum cholera mortality occurs along with a high or maximum temperature in all parts of India excepting Madras, where, as we have seen, the deaths from cholera are most numerous in the cold season, which, however, has a temperature 20° F. higher than that of the cold season in the Punjab. In Bengal and Assam the cholera season precedes the heavy rains, in Madras it follows, while in the other provinces it accompanies them.

The explanation of these differences is to be sought in the physical conditions of the soil as regards moisture in the various regions. In Bengal and Assam the secondary rise, in November, December, and January, may be supposed to be favoured by the moderate degree of humidity which still prevails in many of the marshy and more humid districts during the dry season. In Madras a similar condition of moderate soil humidity is found in the early months of the year after the heavy rains of the winter monsoon. Such conditions are at least rare in Bombay in the winter months, while in the Deccan and the Punjab from November to April the soil is dry and the temperature low compared with Bengal, Assam, and Madras. The drought and cold combined appears to hinder the development and spread of cholera on the elevated table-lands and north-western plains of India during the winter season.

3. Predisposing conditions. The increase of cholera during the famine years shows that starvation renders the system liable to succumb to the infection. Gastric and intestinal disorders, which are most common in the warm season, have probably the same influence. It has been supposed, and perhaps with reason, that the fatigue and privations to which pilgrims are exposed predispose them to be attacked with cholera. But there is not the slightest reason for supposing that fatigue and privation alone ever act otherwise than as predisposing causes. They cannot determine a cholera outbreak, unless the specific cause is present. The great danger of these gatherings lies in the fact that they draw their constituents from all districts, and frequently from cholera-infected districts among others. In this way the spark is provided that determines the epidemic explosions so frequently witnessed in these assemblages. The susceptibility to an attack of cholera may be lessened

for an uncertain time by a previous attack. When, therefore, the disease has been prevalent in a village or town, it acquires, for a time, a certain immunity from further attacks. This, as Flügge suggests, may explain why, in India, where there are almost always unsusceptible districts alongside others which are susceptible, the incidence of cholera is so irregular, the disease leaping over one district or village to attack another. This acquired immunity, according to our present knowledge, does not, however, suffice to explain the periodicity of epidemies to which we shall presently refer. In no epidemy are the whole of the villages or districts in a province so affected, that in any following year cholera could not find a sufficient number of susceptible persons to prey upon in each province. When cholera breaks out in a region in which it appears at long intervals, the mortality is often higher than in endemic areas, or in epidemic areas in which the disease is of more frequent occurrence.

4. Facilities of intercourse by rail, river, and highway also determine the diffusion of cholera to a large extent.

5. Race proclivities. In India the cholera death-rate of the European is higher than that of the native troops. Thus, for the four years 1881–84, it was 1·57 per 1000 of strength in the former and 0·96 in the latter. This refers to India as a whole. In the Bengal Presidency the annual loss per 1000 of the European and native armies from cholera, for the ten years 1867–76, was 5·19 and 2·12 respectively; but for some reason, which I cannot explain, the reverse of this relation obtains in Lower Bengal—the sepoys here suffering more than the Europeans. The average death-rate from cholera of the European army in Lower Bengal from 1861–76 was 2·12, that of the native troops 4·27 per 1000. The cholera mortality of the British troops stationed in the north-west is, on the other hand, much greater than that of the native army, as will be seen by comparing the following figures with those relating to the native army on page 419 :—

Cholera Death-rate per 1000 of the Indo-European Army in the various Divisions of Bengal.

	Bengal Proper.	Gangetic Provinces.	Meerut.	Agra and Central India.	Punjab.	Hill Stations.
1870–79,	0·85	4·24	2·06	3·22	3·95	1·60

The three Presidencies stand in the following order as regards the European army for 1870–79 and 1880–83 :—

	Bengal. Deaths.	Bombay. Deaths.	Madras. Deaths.
1870-79, ...	4·18	1·53	1·68
1880–83, ...	2·49	0·45	0·90

The following, according to Morehead, is the percentage of admissions to strength, of deaths to strength, and of deaths to admissions in the two armies for India as a whole :—

European Army.			Native Army.		
Percentage of Admissions to Strength.	Percentage of Deaths to Strength.	Percentage of Deaths to Admissions.	Percentage of Admissions to Strength.	Percentage of Deaths to Strength.	Percentage of Deaths to Admissions.
2·49	0·84	33·69	0·95	0·35	35·50

It appears from this that the European is much more liable to contract the disease than the native, but that the mortality among the latter is greater in proportion to the cases treated. Is the smaller susceptibility of the natives the result of previous attacks, or is it due to the influence of attenuated doses of the cholera cause,—doses insufficient to occasion actual attacks of the disease, but sufficient to confer a certain degree of immunity; or is it rather the result of the different modes of life of the two races? To these questions I can offer no reply.

5. Epidemic influences. Cholera is eminently an epidemic disease. Its history, imperfect, it is true, seems to point to cyclical periods of prevalence and quiescence of considerable duration. At the present day there is evidence of the existence in India of a triennial cycle of the determining cause of which we are ignorant. By referring to the table at page 421, showing the annual death-rate from cholera in the various governments of India, this three-yearly period can readily be made out. The individual years in the cycle, for the sake of clearness of description, may be distinguished as *a*, *b*, and *c*. In this cycle the highest mortality may occur either in the years *a* or *b*, but as a rule the lowest falls on the third year (*c*). The minimum periods are marked in the table with the sign —, and the instances in which the minimum is not attained in the year when, according to this rule, it is due, are distinguished by the sign †. The famine year 1877 presents an exception to the rule of the minimum mortality occurring in the third year in Bombay and Madras. The year 1883 was also an exceptional one in the Central Provinces, Bombay, Berar, and Madras. It will be seen that in Bengal the first year of the cycle is not always the year when cholera is most severe. In 1884, for example, cholera had begun to increase, but it was not until the following year—the second of the cycle—that it attained its maximum. The same relation is observed in 1881 and 1882—the second year of the cholera cycle, that is, the year 1882, having a higher cholera death-rate than the first. In some

of the other provinces this relation is occasionally observed, although it more generally happens that after the minimum is attained the first year of the new cycle (a) is marked by the highest mortality. It will also be noticed that the first year of a cycle may occupy the first place as regards mortality in one province and the second place in another. Thus, in 1875, the cycle commenced in Bengal with a smaller death-rate than the second year (1876), while in the North-West Provinces, the Punjab, and Berar, the year 1875 began the cycle with the maximum cholera death-rate.

The fact that the cycle, at least as regards the minimum period of cholera prevalence, synchronises, as a rule, all over India, seems to forbid us ascribing this periodicity to meteorological conditions; for, so far as I can make out, the principal meteorological elements vary very considerably in a given year in different regions of the peninsula, and it is doubtful if any corresponding meteorological cycle for India exists. A further objection to any meteorological explanation lies in the fact that in neighbouring localities in a particular district, apparently under the same meteorological condions, the one may suffer during an epidemy and the other escape. Whatever may be the nature of the influences that determine epidemic outbreaks of cholera in India, or the wider extensions of the disease to other lands, there is good reason to believe that the cholera cause has to be transported by infected persons or things to non-endemic areas; that the temperature of the air and the humidity of the soil exert an influence in determining its seasonal evolution where so introduced; and that local conditions and the predisposition of the inhabitants determine the distribution of the outbreaks as regards place, and their intensity in a province where the disease exists.

CHAPTER XVIII.

DIPHTHERIA, ERYSIPELAS, CEREBRO-SPINAL MENINGITIS, WHOOPING-COUGH, MUMPS, SMALLPOX, SCARLET FEVER, MEASLES.

Diphtheria is not altogether unknown in India, but it has no claim to be regarded as endemic in the country. It is supposed to have made its first appearance in Calcutta in the year 1852, and since that date cases of the disease have been observed from time to time. Croup and diphtheria are said to have prevailed together at Darjilling in 1855. In the year 1880 there were 18 cases of diphtheria with 11 deaths; and 40 of croup and laryngitis with 14 deaths, among a body of European children numbering from 6208 to 7593; in 1882 there were 4 deaths from croup among the soldiers' children in Bombay; and in 1884, no fewer than 8 deaths from croup and 2 from diphtheria in Bengal. During the four years 1881–84, the deaths ascribed to diphtheria in Calcutta averaged 12 in a population of nearly half a million. The disease does not appear among the causes of death for these years in Madras or Bombay.

Erysipelas is seldom seen in India except in hospitals. During the period 1869–76 the admission and death rates among the troops for this disease were as follows:—

Bengal.		Madras.		Bombay.	
Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.
2·4	0·09	1·7	0·06	1·4	0·06

In England erysipelas gives rise to an admission-rate (1888) of 2·0, and to a death-rate of 0·05.

Cerebro-spinal Meningitis is rarely seen in India. An epidemy of the disease was, however, observed in Alipore jail in 1885–86.[1]

Whooping-Cough is epidemic in India, but it occurs at long intervals, and is usually of a mild type among the native population. European children are more liable than native children to the disease. Among 7596 children of European soldiers in India in 1880, there were 104 cases of whooping-cough and 3 deaths.

[1] *Ind. Med. Gaz.* 1887.

Mumps appears in mild epidemies in all parts of India, affecting alike the Europeans and native.

Smallpox is endemic in every province of India—no year passing in which it does not cause a certain number of deaths. Smallpox is estimated to occasion about 5 per cent. of the total mortality in India. The annual death-rate from this disease in the European army of Bengal from 1867–76 was 0·15 per 1000, while that of the native army was 0·20 per 1000. It appears at irregular intervals in more or less extended epidemies, but these never cover the whole country in any year. Thus smallpox was epidemic in Madras, the North-West Provinces, and the Central Provinces in 1874, but during that year it was not epidemic in Bombay or Berar. Even adjoining countries do not always suffer simultaneously. It was very fatal in the Central Provinces in 1879, a year in which smallpox was at a minimum in Berar. The conditions on which the epidemic diffusion of smallpox depend are not thus coextensive with the peninsula, but are comparatively limited in their range. Epidemies of smallpox do not occur at regular intervals in any province. It generally prevails in an epidemic form for two or three years in succession, then remains quiescent for the space of two or three years.

The explanation usually given of these periods of quiescence and recrudescence is, that after two or three years of epidemic prevalence, smallpox dies out from the want of unprotected persons to keep it agoing, breaking out afresh after a few years, when the number of unprotected children born during the period of quiescence has accumulated sufficient material to support a new epidemy. The theory is plausible, but is not quite supported by facts. We find that in each new outbreak the majority of persons attacked are not those who have been born during the interval of quiescence, but those who had been living during former outbreaks. An epidemy cannot thus come to an end from the want of susceptible subjects.

Smallpox is to a marked extent a seasonal disease.

The following table gives the percentage of the cases of smallpox occurring in each month, and the monthly rainfall. In the case of the Punjab, the rainfall is the average of Lahore for a period of years. In Bengal, it is the average for the province for a series of years; and in Madras, the mean of 233 observing stations for the year 1881 only. The smallpox distribution is deduced from an average of four years (1881–84):—

Months.	Madras.		Bengal.		Punjab.	
	Monthly Percentage of Smallpox.	Rainfall.	Monthly Percentage of Smallpox.	Rainfall.	Monthly Percentage of Smallpox.	Rainfall.
January, . .	8·8	0·40	8·5	0·54	9·2	0·52
February, .	10·8	0·01	12·9	0·94	10·1	1·30
March, . .	13·4	0·81	16·9	1·24	10·5	0·99
April, . . .	10·5	0·34	17·6	2·33	11·2	0·67
May, . . .	8·5	2·27	15·2	5·14	13·8	0·78
June, . . .	7·4	4·29	10·2	12·10	13·9	1·67
July, . . .	7·5	3·09	6·1	13·94	9·8	6·87
August, . .	7·0	7·63	3·5	13·09	5·3	4·73
September, .	5·9	6·00	2·0	10·53	3·6	2·09
October, . .	5·8	2·71	1·6	4·63	2·6	0·63
November, .	5·8	6·57	1·9	0·48	3·6	0·17
December, .	8·5	2·62	3·3	0·16	6·4	0·58

The smallpox maximum corresponds pretty closely to the dry season, and to an increasing, and, towards the end, a high temperature. In Madras the maximum falls on the three months, February, March, and April; in Bengal, on March, April, and May; in the Punjab, on April, May, and June. The period of the maximum in the Central Provinces is the same as in the Punjab, while in Bombay it corresponds rather with Madras and Bengal.

The minimum throughout India falls on the three months, September, October, and November, which in Bengal and most parts of India corresponds to the subsidence of the rains and the beginning of the dry season; but which in Madras corresponds to the rains of the north-east monsoon. If it were the drought of the early months that determined the spread of smallpox, we should have expected that the rains in Madras in September, October, and November would have had the effect of reducing the percentage of cases in that Presidency below that of Bengal and the Punjab, where October and November are dry months; but such is not the case. The fact, again, that the disease attains its maximum in Madras and Bengal before the temperature has reached its maximum, while it attains its maximum in the Punjab coincidently with the maximum temperature, seems to show that the evolution of smallpox in India does not depend entirely on temperature. Why should the disease be later in attaining its maximum in the Punjab than in Bengal? The temperature attains its maximum in the same month (June) in both provinces; and the rainfall in both alike is at its height in July. If weather regulates the seasonal distribution of smallpox, we must not look for this regulating influence either in rainfall or tempera-

ture alone, but in a combination of increasing temperature and dry weather. But in what way either temperature or rainfall can be supposed to increase the infectiveness of the disease, it is impossible to say.

Measles is frequently epidemic in India, and causes in some years a great mortality among the native children. Chevers states that it is usually epidemic in Calcutta in January, February, and March, appearing in the Upper Provinces at the hottest season of the year. In Calcutta and in other parts of India, according to Mackinnon, many consecutive seasons may pass without a single case of the disease, from which he concludes that the infective principle may be generated spontaneously; a conclusion to which I cannot subscribe.[1]

Scarlet Fever is not endemic in India. A few cases are met with in European children from time to time. A species of roseola, with throat affection, has been observed in Calcutta which in many points resembles scarlet fever, but I have met with no accounts of extensive epidemies of this disease in the country generally.[2]

[1] *Ind. Ann. Med. Science*, Oct. 1854.
[2] *Indian Med. Gazette*, 1887, p. 15.

CHAPTER XIX.

DISEASES OF THE RESPIRATORY ORGANS.

Phthisis occupies by no means an insignificant position in Indian pathology. The mean annual death-rate of the European army of Bengal from 1867 to 1876 stood at 1·38 per 1000. This figure is, however, much in excess of the later returns. The death-rate from phthisis of the Indo-European army for the years 1881–84 was 0·69, against a ratio of 0·88 per 1000 among the troops stationed in the United Kingdom. The death-rate of the native army for the ten years 1867–76 averaged 0·77 per 1000. From this we may infer that if the civil population of India generally were as well fed, clothed, and cared for as the native soldier, the phthisical death-rate of India would be under that of Great Britain. There can, however, be little doubt that phthisis makes many victims among the cachectic and under-fed population of India. In Bombay (city) the average death-rate from phthisis for the years 1882–85 is given at 3·63 per 1000—a proportion very much in excess of that of England. We do not have the figures for the other two Presidency towns. In the jail population of India the admission-rate averages 5·7, and the death-rate 2·30 per 1000. Chevers[1] states that in the ten years 1857–67 there were 454 cases of phthisis treated in the Medical College Hospital of Calcutta, with a population of about half a million; but unless we knew something of the proportion of phthisical patients that take advantage of this institution, the figures have little meaning to us. So far, however, as we have the means of judging, phthisis is more fatal in the large towns of India than in England.

The comparative fatality of consumption in the three Presidencies, so far as this is indicated by the admission and death rates of the European troops from 1879–83 from this disease, is given in the following table from Parkes. It must be noted as affecting the admissions, that scrofula is included:—

[1] *Commentary on the Diseases of India*, Lond. 1886.

Bengal. Deaths per 1000.		Madras. Deaths per 1000.		Bombay. Deaths per 1000.	
Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.
7·0	1·45	6·5	0·97	7·2	1·21

It may be remarked that the phthisical death-rate of the native troops follows the same distribution. Phthisis would thus seem to be most common in Bengal, and least so in Madras—Bombay occupying an intermediate position between the two. That Madras, as a whole, suffers only to a moderate extent from phthisis, is confirmed by the fact that consumption forms only 1·1 per 1000 of the cases treated at the dispensaries.

Out of each 100 deaths from all diseases occurring among the native troops in Bengal (cholera and violent deaths excluded), phthisis caused the following proportions in the different military circles during the period 1867–76 :—

Bengal Proper.	Gangetic Provinces.	Meerut and Rohilkund.	Punjab.	Punjab Frontier.
7·4	10·6	11·9	5·1	4·0

The region skirting the Himalayas appears to be specially affected by the disease. Among the Goorkha regiments stationed at Dehra, Almora, Dhurmsala, Bakloh, and Abbottabad from 1867–76, the proportion of deaths from phthisis to the total mortality was as high as 20·3 per cent.; while, as we have just seen, the proportion among the native troops stationed in the Gangetic Provinces was only 10·6 per cent. All authorities concur in stating that phthisis is comparatively rare both in Lower Bengal and Assam; but the general accounts we meet with in medical literature do not entirely confirm the rarity of the disease on the Punjab frontier, which the above table appears to indicate.

So far as I can judge, phthisis is less common along the eastern than on the western coast of the peninsula. Upper Sind, the higher elevations of the Western Ghats and of the Himalayas, are not free from consumption, but in these regions it is comparatively rare. In Coorg, however, at an elevation nowhere under 3000 feet, phthisis is said to be very common (Chevers).

The table-land of the Deccan suffers less from phthisis than the plains of Upper Bengal. As regards European residents, Chevers gives it as the result of his long experience, that if a person arrives in Bengal free from the disease, is not subjected to extraordinary hardships, and lives prudently, he will never be attacked by phthisis during his residence in Lower Bengal.

Diseases of the Respiratory Organs.—As the mortality from this class of diseases is not, as a rule, given in the death-returns of the

civil population, we shall have to rely chiefly on the data furnished by the medical reports of the European and native armies, in estimating the prevalence of chest affections in India as a whole, and their incidence on the different provinces.

The average admission-rate from all diseases of the respiratory organs, excluding phthisis, in the Indo-European army for the ten years 1870–79 was 75·0 per 1000, and the death-rate 0·97 per 1000. The ratios for the four years 1881–84 were 76·8 and 0·98 respectively. Comparing these figures with those relating to the troops stationed in the United Kingdom, we find that, during the five years ending 1887, the admission-rate was 65·4 and the death-rate 1·33 per 1000 for this group of maladies. Taking the health, then, of the English troops as our measure of comparison, we should conclude that chest affections (excluding phthisis) are more prevalent, but less fatal, in India than in England; but it has to be borne in mind that the death-rate of India is reduced by the invaliding home of cases that would otherwise have proved fatal in the country.

In the native army the admission-rate from 1881–84 averaged 61·1 and the death-rate 4·37 per 1000. The proportion of deaths from respiratory diseases to the total deaths in the European and native armies of Bengal for the period 1867–76 was respectively 6·4 and 23·4 per cent., and the deaths per 1000 of strength, 0·99 and 2·57. From this it appears that these diseases are about four times as fatal amongst the native as amongst the European soldiers. The lower death-rate of the European from this class of affections is partly explained by his stronger constitution; by the fact that his residence in the country being comparatively short, his system is less saturated with malaria; and also, perhaps, because his food, dress, habits, and lodgings are more favourable to recovery. There is a good deal of evidence to show that chest affections assume an exceptional gravity in European troops debilitated by malaria. Thus, it is recorded that in 1879, out of 19 deaths occurring in the 1st Battalion of the 6th Regiment, 11 were due to pneumonia. This battalion, then stationed in the Bombay Presidency, was composed of men who, we are told, were much debilitated with malaria which they had contracted in Bengal.

The inference as to the fatality of respiratory diseases in the natives of India, derived from the vital statistics of the native army, is confirmed by other available sources of information. The average admission-rate for chest affections in the Bengal jails, during the ten years ending 1882, was 44 per 1000, and the death-rate 7·18 per 1000 of the mean strength. In the city of Bombay,

again, respiratory diseases gave rise to an average death-rate of 4·48 per 1000 living during the four years 1881–84, as against the English average for the same period of 3·49 per 1000.

An attempt was made, in 1884, to classify 3261 deaths occurring in 120 villages of Berar. The result showed that 489, or 150 per 1000, were due to pneumonia, bronchitis, and asthma; and although pleurisy is not expressly mentioned, it was doubtless included. As these four diseases caused 157 per 1000 of the total mortality in England during the same year, it follows that these diseases are somewhat more fatal in England than in Berar; but, as we shall presently see, Hyderabad, which adjoins Berar, is one of the provinces in which respiratory diseases are less frequent than in most parts of the peninsula.

Having considered the prevalence of respiratory diseases in India as a whole, we shall now endeavour to determine their comparative prevalence in the three Presidencies, and in the individual provinces.

The subjoined table gives the admission-rates per 1000 from respiratory diseases among the European troops in the three commands for two series of years:—

	Bengal.	Madras.	Bombay.
1870–79, ...	84·0	57·0	64·0
1881–84, ...	83·5	43·5	83·0

The same relation as to the incidence of respiratory diseases on the three Presidencies is brought out by the death-rates of the native army. During the four years 1881–84 the death-rate of the troops in Bengal and Bombay from chest diseases was more than double that of those stationed in Madras.

Coming now to the frequency of respiratory diseases in the various military divisions of the three Presidencies, we shall give in a tabular form the admission and death rates among the European troops for a series of years:—

Admission and Death Rate from Respiratory Diseases.

Bengal.

	Admissions per 1000.	Mortality per 1000.
Average 7 Years.		
Presidency,	31·31	0·68
Allahabad,	47·92	0·60
Oudh,	44·03	0·43
Rohilkand,	39·07	0·64
Saugor,	43·58	1·49
Gwalior,	42·39	0·63
Meerut,	49·39	1·15
Sirhind,	49·91	0·81
Lahore,	78·19	1·72
Rawal Pindi,	74·36	1·53
Peshâwar,	64·67	1·74

Bombay.

	Admissions per 1000.	Mortality per 1000.
Average 4 Years.		
Presidency,	37·07	1·07
Sind,	51·07	1·68
Average 3 Years.		
Poona,	52·60	0·51
Mhow,	59·77	0·95

Madras.

	Admissions per 1000.	Mortality per 1000.
Average 4 Years.		
Centre and North,	21·95	0·61
South Malabar,	30·11	Nil
Hyderabad,	24·13	0·29
Burma,	35·68	0·48
Average 3 Years.		
Mysore,	37·09	0·06
Nagpur,	31·67	0·79

Before considering the distribution of respiratory diseases as illustrated by this table, it will be well to give the admissions and death rate among the native troops for comparison. The averages are for the four years 1881–84 except when otherwise stated. For some of the regions I have not obtained the admission-rates.

Admission and (or) Death Rates from Respiratory Diseases among the Native Troops in various Districts in India.

Bengal.

Lower Bengal and Assam.		Gangetic Provinces.		Rohilkand and Meerut.		Punjab.	
Adm.	Deaths.	Adm.	Deaths.	Adm.	Deaths.	Adm.	Deaths.
82·5	2·85	53·2	2·32	49·0	3·25	65·0	5·95

Central India and Madras.

Agra and Central India.		Hyderabad.	Madras.
Admissions.	Deaths.	Deaths (1883).	Deaths.
49·0	2·11	1·15	1·51

Afghanistan, North and South, and Bombay.

Punjab Frontier Force.		South Afghanistan.	Bombay.
Admissions (1883, 1884).	Deaths (1881-84).	Deaths (1881–83).	Deaths (1881, 1883, 1884).
90·5	9·23	24·57	4·13

The percentage which deaths from respiratory diseases bears to the deaths from all causes among the native troops in the various military divisions of Bengal (1867–76) is as follows :—

Bengal Proper.	Gangetic Provinces.	Meerut and Rohilkand.	Punjab.	Punjab Frontier.
11·8	18·0	19·7	33·3	38·4

It will be seen that the admissions among the European troops from chest diseases in Bengal increase, upon the whole, as we advance to the north-west, attaining their maximum in Lahore, Rawal Pindi, and Pesháwar. For some reason or other the prevalence of these diseases in the native army is greatest in Lower Bengal and Assam; they are least frequent in the Gangetic Provinces, Rohilkand, and Meerut, but increase again in frequency in the Punjab. The death-rate in both armies is greatest in the Punjab. In the European army, the Presidency division shows a higher death-rate than Allahabad, Oudh, and Rohilkand, with a distinct rise in Meerut. A somewhat better idea, perhaps, of the prevalence of these diseases in Northern India is obtained from a comparison of the admission-rates among the native troops at particular stations from Assam to the North-West Frontier. The figures we give are for 1867–76 :—

Dibrugarh.	Barrackpore.	Lucknow.	Bareilly.	Ferozepore.	Jhelum.	Pesháwar.
44·9	61·0	30·1	25·9	32·8	40·0	64·1

Although the military divisions occupied by the native troops and the circles of the European army do not entirely correspond, a similar incidence of respiratory diseases in the different regions may

be traced in both. Central India appears from both tables to be only moderately subject to chest complaints. Nagpur, Hyderabad, and the Mysore division of Madras representing the Deccan, show collectively comparatively low admission and death rates among the European troops, just as Hyderabad and Madras show the minimum death-rates in the native army. The Punjab, both for the native and European, is a government in which respiratory diseases are highly prevalent. North and South Afghanistan are the regions where chest affections are most fatal in the native army, but the mortality was increased by field service for the years with which we are dealing. The death-rate of Bombay was also raised above the normal, by troops which had returned from frontier service. Sind is the district in Bombay where respiratory diseases are most fatal. Poona and Mhow those where they are most frequent but least fatal.

In Madras, both on the coasts and on the table-land, where chest affections are rare, the temperature is generally equable, the annual range varying from 6°·5 F. at Goa on the west and 12°·3 F. at Madras on the east coast, to 17°·9 F. at Secunderabad in the interior at an altitude of 1800 feet. In Bengal, chest affections are seen to increase in fatality as we advance westwards and northwards, and as the range of temperature becomes greater, so that when we reach the Punjab, where the vicissitudes of temperature are most marked, the deaths from respiratory diseases form about one-half of the total mortality among the native troops, and no insignificant item in the death-rate of the British force. In this province it is at Pesháwar, Kohat, and Edwardesbad on the Western Frontier, where the annual mean range may reach 39° or 40° F., and where the daily range is also very considerable, that chest affections among the native troops attain their maximum. In the Bombay Presidency respiratory diseases are only moderately fatal in Poona, where the temperature is equable, but become much more severe in the Sind circle, especially towards the north and west, where the range of temperature is high.

As pneumonia forms about 23·4 per cent., that is, somewhat less than one-fourth of the respiratory diseases treated, and no less than 79·1 per cent. of the fatal cases, it follows as regards these tables with which we are dealing, that as bronchitis accounts for nearly 80 per cent. of the admissions, and pneumonia for nearly the same proportion of deaths, the distribution of bronchitis in the different provinces will be roughly indicated by the admission-rates, and that of pneumonia by the death-rates from respiratory diseases. Taking this as our guide, bronchitic complaints appear to be more frequent among the native troops in Lower Bengal and Assam than

in any of the military divisions of the Presidency. Pneumonia, as measured by the death-rate, is most frequent in the Punjab, especially on the Western Frontier and in South Afghanistan. Rohilkand and Meerut also show a high degree of prevalence of pneumonia. The number of the troops belonging to Bombay, returned from service in Afghanistan, had, for the years with which we are dealing, augmented the proportion of deaths from pneumonia in that Presidency above the normal rate. The regions where pneumonia is least common are Hyderabad and Madras. From all this it appears that pneumonia is most prevalent and fatal in those regions where the vicissitudes of temperature are greatest.

In India, pneumonia is often either a complication of malarial fever or of the malarial cachexia. In 1869–70 pneumonia was observed to be a frequent complication of fever at Kohat, Bunnoo, and other stations in the Punjab. There are numerous accounts of the epidemic prevalence of pneumonia in India. In some instances they refer to an unusual frequency of the disease among men who have been exposed to the fatigues of war. Many of these outbreaks have occurred in men who were either actually stationed on the Western Frontier or who had recently left it. In several instances, again, pneumonia has broken out in an epidemic form in prisons. In some epidemics the disease has been thought to be contagious; and in one instance of this kind occurring on the frontier of the Punjab, Dr. Gillies discovered a microbe which, he thought, was the cause of the disease.[1]

Pleurisy follows the same rule as regards distribution as that which regulates diseases of the respiratory organs as a class; that is, it is most frequent in Bengal, less so in Bombay, and least common in Madras. Its proportion to the total of respiratory diseases is similar to that observed in England, but in India it appears more frequently to terminate in empyema than in England.

What we have stated respecting the comparative prevalence and fatality of pneumonia and bronchitis refers, of course, only to the military age.

Bronchitis is a disease which makes most victims at the two extremes of life, viz. infancy and old age. In India, as elsewhere, bronchitis is actually the most fatal of the respiratory diseases at all age-periods, although not in proportion to the numbers treated. In Bombay, in 1885, the deaths ascribed to bronchitis numbered 2468, to pneumonia 874, and 7 to pleurisy and pleuro-pneumonia. A few epidemics of bronchitis have been observed in India, but it is doubtful whether they do not rather refer to influenza.

[1] *Army Medical Report*, 1881. See also Chevers, *Indian Medicine*, London 1886.

The following is the monthly percentage of deaths from respiratory diseases in the native army of India founded upon the returns of 1864–73 as given by Bryden :—

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21·8	12·8	10·8	7·9	6·0	2·8	2·6	2·7	2·2	3·7	10·3	16·4

Respiratory diseases give rise to one-fourth of the mortality in the native army; and no less than 51 per cent. of the deaths from this class of affections occur in the three months, December, January, and February. The months, July, August, and September, are those when respiratory diseases attain their minimum fatality. Pneumonia probably does not differ materially in its seasonal distribution from that of respiratory diseases as a whole. The following, according to Morehead, is the monthly percentage of cases observed at Bombay :[1]—

Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
9·7	12·6	10·3	8·7	8·7	7·4	3·0	6·0	6·8	9·4	6·5	11·0

[1] Morehead, *Trans. Bombay Med. Soc.* 1855.

CHAPTER XX.

DISEASES OF LIVER AND SPLEEN.

Hepatitis is one of the more fatal diseases of the English soldier in India. The death-rate from this cause in the Indo-European army, during the decennium 1870–79, averaged 2·19 per 1000, while during the five years 1880–84 the ratio had declined to 1·32 per 1000. The disease is much less fatal in the native army. In 1883, the death-rate from hepatitis in the British force was 1·13, and that of the native army 0·18 per 1000. From this it appears that inflammation of the liver is rather more than six times as fatal to the European as to the native soldier. This difference between the death-rate of the two armies is probably to be ascribed more to the freer use of spirituous liquors by the European soldier than to race predisposition.

Morehead gives the proportion of admissions from acute hepatic affections, in the European General Hospital of Bombay, to the total admissions as 3·7, and that in the Jamsetjee Jejeebhoy Native Hospital as 1·5 per cent. The rate of mortality was 14·1 per cent. in the former, and 34 per cent. in the latter.[1] It follows from this that civilian Europeans in Bombay are more liable to hepatitis than the native community, but that the disease is more fatal, in proportion to the numbers treated, among the latter.

The incidence of the disease on the three Presidencies, as indicated by the death-rate of the European troops, is as follows:—

	Bengal.	Madras.	Bombay.
1870–79, . .	2·04	3·16	1·71
1880–84, . .	1·27	1·66	1·10

Hepatitis is thus more fatal in the Madras Presidency, where malarious diseases are least frequent. Bengal occupies the second place, and Bombay suffers least from inflammation of the liver. It will be observed that dysentery and hepatitis have the same geographical distribution in India, and I think that this rule is of more general application. Hepatitis is common along the south-east coast of Madras, but its prevalence varies greatly at different points. The

[1] Morehead, *Clinical Researches on Disease in India*, 2nd ed., London 1860.

region where hepatitis attains its maximum, among the English troops, is the eastern district, comprising Madras, Palaveram, and St. Thomas' Mount. During the seven years 1882–88, the admissions and deaths for hepatitis and abscess of the liver in this district were 50·6 and 4·77 per 1000 respectively. Cannanore, on the west coast, shows in certain years a high ratio of deaths. Cochin, to the south of Cannanore, is said to suffer less. On the table-land of the Deccan, although less frequent than in the Madras district, hepatitis is frequently met with. At Secunderabad, the ratio of admissions and deaths among the troops, during the eight years ending 1888, were 25·9 and 1·63 per 1000 respectively. The disease is somewhat less common and fatal at Bangalore.[1] Rangoon, in Burma, which belongs to the Madras command, is a station where hepatic inflammation is of rather frequent occurrence. A seven years' mean (1882–88) gives a ratio of 39·68 admissions and 2·74 deaths from hepatitis in Lower Burma.

Hepatitis is less frequent in the Bengal command. We subjoin the ratios of admissions and deaths per 1000 in each circle:—

ADMISSIONS AND DEATH RATES FROM HEPATITIS, AND ABSCESS OF THE LIVER, IN BENGAL. AVERAGE OF THE EIGHT YEARS 1881–88.

Circle	Admissions.	Deaths.
Presidency.	31·6	1·85
Allahabad.	40·0	1·57
Oudh.	29·1	1·40
Rohilkand.	20·8	1·48
Saugor.	21·0	1·3
Gwalior.	21·6	1·20
Meerut.	25·5	1·06
Sirhind.	28·6	1·55
Lahore.	22·3	0·99
Rawal Pindi.	23·6	1·09
Pesháwar.	22·9	0·80

Without laying much stress upon the minor differences between the admission and death rates of the individual stations, it will be observed that hepatitis becomes less prevalent and fatal as we advance towards the north-west, and the deaths from this class of maladies in the Punjab, would probably be still fewer in troops that had not already been stationed in the eastern plains.

In the city of Bombay, inflammation of the liver does not appear to be very frequent. In 1885, I find that acute affections of the liver formed only 10·8, and all liver diseases 11·2, per 1000 of the total deaths—a proportion less than that which obtains in England. In the Konkan and Sind, the cases of liver disease—an indefinite term—form about 5·5 per 1000 of the total treated, whether as in-door or out-door patients, in the hospitals and dispensaries; while in Gujerât and the Deccan they form only 2·5

[1] Mouat, so far back as 1834, remarks the prevalence of hepatitis at Bangalore, which, as he says, "is difficult to account for," seeing that the climate is healthy. *Med. Chir. Rev.* 1834.

per 1000 of the cases. The army returns are scarcely available for the Bombay Presidency on account of the changes in the arrangement of the circles, which prevent the comparison of a series of years. They seem, however, to show that hepatitis is most common but least fatal in the Bombay and Poona circles, while the cases are fewer in Sind and Mhow, but the deaths more numerous. At Nasirabad, in the Mhow circle, situated at an altitude of 1670 feet, hepatitis is more common than in India as a whole. At Quetta the ratio of admissions for the period 1882–85 was 13·0 per 1000, and the deaths 2·0 per 1000. This appears to indicate that the extremes of heat and cold, so marked at this station, tend to develop a dangerous form of the disease, at least in troops coming from the warmer districts, and who may have already suffered from hepatic congestion. We have no means of knowing whether hepatitis is prevalent among the natives of that district, for the comparatively high death-rate of the troops stationed there cannot be looked upon as conclusive on this point.

In Bengal the maximum of admissions and deaths in the army falls on the third quarter; and the same is the rule in the Bombay Presidency as regards admissions, although the period of the maximum death-rate is variable. According to Morehead's statistics, the admissions from acute hepatic affections in Bombay attain their maximum in the cold months of January, February, and March. In Madras, the first quarter is generally that in which the maximum of admissions and deaths occur.

The European soldiers suffer to a greater extent from hepatitis than their wives, and these again are more liable to the disease than the children. In 1888, hepatic affections, mostly inflammatory, caused a ratio of 30·9 admissions and of 1·5 deaths per 1000 among the soldiers; of 18·0 admissions and 0·3 deaths among the women; and in the two Presidencies of Bengal and Madras for which we have the details, 2·3 per 1000 admissions and 0·6 deaths among the children. Hepatic abscess is by no means unknown among the wives and children of the European soldiers. In 1879 there were three cases of liver abscess out of 2421 women. In 1882 I find three cases of this kind recorded, and one in 1884.

Among the children, numbering 3478, there were two cases of abscess of the liver in 1888; and instances of hepatitis terminating fatally in European children are of somewhat frequent occurrence.[1]

[1] I have classed liver abscess with hepatitis, but it is by no means certain that tropical abscess is to be looked upon as the termination of ordinary inflammation; it is probably due to causes different from those that lead to what is generally spoken of as hepatitis.

We must ascribe the lesser liability of the soldiers' wives to hepatitis, to their greater sobriety, and to their being less subjected to climatic influences and to fatigue. That the climate has a powerful influence, however, in predisposing the European to acute hepatic diseases, is proved by the fact that inflammation of the liver is much more frequent among the soldiers in India than among their comrades in England, although their habits are probably pretty much the same in both countries; and also by the fact that the women and children, although they enjoy a comparative immunity from the disease, nevertheless suffer from inflammation and abscess of the liver to a far greater extent than the natives of temperate climates.

Diseases of the Spleen are common throughout India, their distribution being determined by the prevalence of malarious conditions in the different localities; but it does not follow that they are in proportion to the death-rate from malarial fevers. It has been estimated that in some of the more malarious districts, one-fourth of the inhabitants suffer from distinct splenic tumours.[1]

The average admission-rate per 1000 in the different military divisions of the Bengal native army from diseases of the spleen, for the period 1881–84, was as follows:—

Bengal and Assam.	Gangetic Provinces.	Rohilkund and Meerut.	Agra and Central India.	Punjab.
14	12	8	11	10

Spleen diseases are thus more common in the moist, warm, marshy regions of Lower Bengal and Assam, than in the drier, colder country to the north-west.

Spleen diseases in Sind form a larger proportion of the total cases treated in the hospitals and dispensaries than in any of the other divisions of Bombay. The Konkan has the next largest number, then follows Gujerât, and last the Deccan. This is not quite the distribution that might have been anticipated. I do not know in what proportion the different districts of Madras suffer, but diseases of the spleen give rise in Madras to about half the proportion of admissions which they do in Bombay, and to a third of the number they occasion in Bengal.

As spleen diseases are generally associated with fever, deaths are, as a matter of course, in most cases returned under the heading of fevers. No just estimate can thus be formed of the mortality resulting from this class of diseases. In the native army it is given in 1881 at 0·10 per 1000 of strength; and in the jails, during the ten years ending 1882, the mortality from diseases of the spleen averaged 0·35 per 1000 of mean strength.

[1] *S.C.R.* North-West Provinces, 1885, p. 73.

CHAPTER XXI.

RHEUMATIC AND VENEREAL DISEASES, DROPSY, SCROFULA, SCURVY, ULCERS, LEPROSY, ETC.

Rheumatic Affections are common both among the native population and the European residents. The admission and death rates in the Indo-European army are somewhat higher than in England. During the eight years 1869–76 the admission and death rates in the three divisions of the army were as follows:—

Bengal.		Madras.		Bombay.	
Admission-rate.	Death-rate.	Admission-rate.	Death-rate.	Admission-rate.	Death-rate.
52·5	0·02	39·3	0·01	40·6	0·05

Bengal is thus the Presidency where rheumatic diseases are most prevalent, Bombay that in which they are most fatal, while Madras has at once the lowest admission and death rates.

The average admission-rate per 1000 of the native troops of the Bengal army for rheumatic affections, in each of the military divisions, for the period 1881–84, was as under:—

Lower Bengal and Assam.	Gangetic Provinces.	Rohilkund and Meerut.	Agra and Central India.	Punjab.
48	49	40	36	34

It will be observed that rheumatism gives rise to more admissions in the plains of Lower Bengal and Assam than in the Punjab, where the climate is so much more severe and extreme. In Bombay, the deaths from acute and chronic rheumatism among the native population in 1888 were in the ratio of 1·37 per 1000 of the deaths from all causes—a proportion slightly under that of England. In 1888, rheumatic affections formed 4·8 per cent. of the cases treated in the Madras dispensaries, and 4·4 per cent. in those of Assam. Rheumatic affections are everywhere most prevalent in the cold months, November to February.

Venereal Affections.—It is rather difficult to arrive at a satisfactory conclusion as so the prevalence of venereal diseases among the natives. Some writers, such as those quoted by Lombard,[1]

[1] Lombard, *Climatologie Médicale*, vol. iv. p. 123.

represent syphilis in India as "extremely frequent and grave, manifesting itself by tumours, mutilated noses, ulcerations of the tongue, palate, and throat; the penis being, it is said, often entirely destroyed by phagedenic ulcerations." Chevers, on the other hand, observed no notable peculiarities in type either as regards the primary or secondary manifestations of the disease as seen in Bengal. The admission-rate among the English soldiers in India as a whole, from venereal diseases, during the ten years 1870–79, was 203, and during the five years 1880–84 it rose to 268, per 1000. For the ten years 1870–79 the average admissions for Bengal was 209; for Madras, 198; and for Bombay, 191. For the five years 1880–84 they stood thus: Bengal, 279; Madras, 283; Bombay, 253. Taking the year 1884, the proportion of admissions per 1000, from the primary and secondary forms, and from gonorrhœa, in each Presidency was as follows:—

	Bengal.	Madras.	Bombay.
Primary Syphilis, . .	86·7	101·7	89·7
Secondary Syphilis, . .	25·3	26·3	19·9
Gonorrhœa, . . .	147·5	135·8	142·3

All this points to a high degree of prevalency, but to no extraordinary malignancy, in the disease among the European soldiers; but it is obviously unsafe to judge of the prevalence of this class of diseases among the civil community generally by their frequency among the military. Indeed, we have only to observe the proportion of admissions among the native troops to convince us of this. In 1881, when the admission-rate from venereal diseases among the Europeans was 260 per 1000, it was only 39·5 per 1000 among the native troops, and it usually remains at a similar figure. This great difference is not to be ascribed to the greater continence or prudence, or to the lesser susceptibility of the native, but rather to the greater proportion of married men in the native army. Altogether, I am inclined to think that syphilis is not more diffused nor more malignant in India than in Europe. According to Chevers, syphilis has been observed to increase in prevalence and to become more aggravated in type during famine. May not this be owing to hunger compelling many women to resort to prostitution who would otherwise lead regular lives?

Dropsy, *Anæmia*, and *Debility* are widely prevalent in India, and give rise to a considerable mortality among the civil population generally, especially among the poorer classes and among prisoners. In the native army these diseases are much more fatal than among the European troops. To illustrate this it will not be necessary to state averages, the ratios of any year will suffice to show how much

more subject the native is to these diseases than the European, even when, as in the case of the native soldier, he is supplied with ample nourishment. In 1883 the death-rate from these three diseases in the Indo-European army was 0·06 per 1000; in the native army, 0·66 per 1000; that is, the mortality from dropsy, anæmia, and debility was eleven times as great in the native as in the European army.

The explanation of this is, no doubt, in part to be found in the less nourishing diet of the native, but also, and perhaps chiefly, in the continuous action of the malarious infection to which he is subjected.

Scrofula is a rare disease among the natives of India. The only regions in which scrofulous swellings of the glands are at all common, are on the slopes of the Himalayas and in the mountainous districts of Coorg.

Scurvy is a disease which readily manifests itself in India amongst those who are not entirely deprived of vegetable food, and sometimes even when there is no deficiency of vegetables. Thus, in 1879, eleven cases occurred in the 68th Regiment, stationed at Meean Meer. The medical officer remarks that the occurrence of the disease cannot be accounted for, as there had never been a deficiency of vegetables throughout the year. In all the cases the patients had been very subject to ague, and had become anæmic in consequence. This relation of scurvy to ague is often overlooked; a person suffering from anæmia caused by malaria is specially liable to scurvy. Chevers states that scurvy is most frequent is Sind and Behar. This is perhaps owing to the scanty vegetation of these parts at certain seasons.

Ulcers, Boils, and *Abscesses,* apparently of a non-specific character, are exceedingly common, especially among those subject to malarial cachexia, or suffering from a scrobutic taint. Abscess and ulcer cause, on an average, 123 admissions per 1000 in the Bengal native army. In the dispensaries of Madras, in 1886, out of 2,017,159 patients treated, there were 200,236 cases of ulcer,—a proportion of 99·2 per 1000, or nearly one-tenth of the total treated; while in Bombay they form 77 per 1000, and in Assam the ratio is 55 per 1000. These complaints are frequent in many parts of the Bengal Presidency. Judging from the admissions for abscess and ulcer among the Bengal native troops, these complaints are least prevalent in Lower Bengal and Assam, and are most frequent in Agra and Central India. They are most common in the warm season. The specific sore known as Delhi boil is met with in the North-West Provinces, the Punjab, Rajputana, and Sind. In Delhi,

where it was once so common, it is now comparatively seldom seen.

Leprosy is endemic to a vast extent throughout India. The following table gives a statement of the incidence of the disease on the various provinces, the proportion in which it affects the sexes, and the ratio in which the followers of some of the principal religions suffer from the malady:—

Ratio of Lepers per 100,000 of the total Population of each Province or State of India.

Ajmere,	6·3	North-West Provinces (British Territory),	40·4
Assam,	67·9	North-West Provinces (Feudatory States),	58·4
Bengal,	81·3	Punjab (British Territory),	36·5
Berar,	140·2	Punjab (Feudatory States),	73·9
Bombay (British Territory),	61·4	Baroda,	28·6
Bombay (Feudatory States),	32·9	Cochin,	24·7
Burma,	69·3	Hyderabad,	30·4
Central Provinces,	65·5	Mysore,	12·7
Coorg,	24·1		
Madras,	46·8		
All India,	57·3		

The Ratio of Male Lepers,	84·5	per 100,000.
,, Female ,,	29·0	,,
,, Buddhists,	70·0	,,
,, Hindoos,	60·0	,,
,, Mohammedans,	50·0	,,
,, Parsees,	39·0	,,

The proportion of lepers to the population in India, as ascertained by the census of 1881, is 57·3 per 100,000; but there is reason to believe that this is much under the true number. The compiler of the Bengal census-returns remarks that many female lepers escape enumeration; and that often those only, whether male or female, in which the disease is so pronounced as to attract attention, are returned. According to this authority, instead of there being 8 lepers per 10,000 of the population in Lower Bengal, they probably amount to three or four times this number. In Bengal proper, the ratio of lepers is 9 per 10,000 of the inhabitants; in Behar, 5; in Orissa, 12; and in Chota Nagpur, 5 per 10,000. In the Burdwan division of Bengal proper, the proportion is 19; in the Rajshahye division, 9; in the Presidency division, 6; in Dacca, 5; and in Chittagong there is only 1 leper per 10,000 of the population.

In Assam, leprosy attains its highest prevalence in the Surma valley, then in the eastern districts of the Brahmaputra valley. The Naga Hills do not escape, but the disease is comparatively rare in the Khasi and Jaintia Hills.

The hill district of Kumaum is the locality which is most affected in the North-West Provinces, having the heavy pro-

portion of 16·1, against the provincial ratio of 4·04 per 10,000.

In the Punjab the districts most affected are—first, the hills, then the submontane country, next the eastern plains, and, last, the western plains, where the disease is rare.

The Deccan is the division in Bombay where the leprosy is most common—Khandesh, Satara, and Poona, adjoining the great leper centre of Berar, being those chiefly affected. In the Konkan, the district of Ratnagiri takes the first place as a leper centre, Kolaba occupying the second rank. In the Western Karnatic, leprosy is by no means prevalent, except in Belgaum, which has a high ratio. In Sind and Gujerât leprosy is comparatively rare.

Berar is distinguished as the province in which leprosy is most widely diffused,—the plains, as a rule, suffering more than the hills, although some of the hill districts show a larger ratio of lepers to the general population than do individual localities on the plains. The "taluks" that suffer most are Malkapur, Murtazapur, Belapur, and Morsi, where the ratios range from 19 to 24 per 10,000.

In Madras, the north-eastern littoral from Ganjam to Madras shows ratios varying from 3 to 6 per 10,000, while the inland districts of Kurnool, Bellary, and Cuddapah are less severely affected,—the ratio being lowest in Cuddapah, where it stands at 1·6, and highest in Kurnool, where it is 3·1 per 10,000. The city of Madras and the districts of North and South Arcot form an area within which leprosy is more prevalent, the ratios varying from 6·0 in North Arcot to 7·4 per 10,000 in Madras. To the south of this area, both along the coast and inland, leprosy is less common. On the west coast leprosy is most prevalent in the South Kanara district, but it diminishes in frequency as we advance southwards to Malabar and Cochin.

Leprosy is thus seen to be very irregularly distributed in India. Extensive areas, such as the plains of the Western Punjab, joining on to Sind, Gujerât, and Ajmere, are only slightly affected. We meet again with smaller areas of minimum prevalence, as at Chittagong on the east, and Balasore on the west, of the Bay of Bengal. In other regions, more or less extensive, as Berar, the Burdwan division of Lower Bengal, the hill districts of the Punjab and of the North-West Provinces, and the coast districts, of which Madras is the centre, leprosy is excessively prevalent.

Within these areas, again, where leprosy prevails, the disease is not uniformly diffused. On the contrary, within even the more limited leper districts, where the general conditions of soil, climate,

race, and habits are similar, leprosy is much more prevalent in some localities than in others, certain villages being affected in different degrees, and others escaping entirely. Thus, in the Malkapur "taluk," the most leprous district of Berar, lepers are found in only 48 per cent. of the villages, the other 52 per cent. being free from the disease. Within a leprous town the malady is generally confined to a larger or smaller number of families, of which several members usually suffer. It is thus essentially a family disease. It would have been interesting to ascertain more particularly the manner of its distribution in those localities where the disease is rare. If it were found to exist, not in village or family groups, but in isolated and solitary cases, there would have been strong grounds for suspecting a *de novo* origin for the disease; but all the facts that we have ascertained seem to point to heredity or contagion as the means of its spread and the cause of its persistence in a given locality.

Leprosy, as we have seen, is not restricted to the littoral, but is, in fact, excessively common along the southern slopes of the Himalayas, from Kashmir to Nepal. In the hilly region of the Punjab there are localities in which the proportion of lepers is as high as 40 to 50 per 10,000 of the inhabitants. In Bengal, too, it will be noticed that the chief seats of the disease are found in the inland districts. Even when leprosy is prevalent in the littoral districts, the localities most affected are frequently not those immediately along the shore, but at some distance inland, as in the case of Rajapoor in the Ratnagiri district of Bombay, which was formerly, at least, the headquarters of leprosy in that district, but situated at a considerable distance from the sea.

All races suffer from this loathsome malady, but in varying proportions. The Buddhists and Hindus suffer to a larger extent than the Mahommedans or Parsees. In some districts the Christians furnish the largest proportion of lepers in the community.

The evidence before us lends no support to the view that leprosy is caused by a fish diet.

Referring to the prevalence of leprosy in Bankoorah and Beerbhoom, the compiler of the census observes, "that a fish diet must be without effect there, as there are few or no marshes or tanks, and fish is comparatively rare as an article of food, while the eastern districts of Bengal, where fish is plentiful and cheap, have few lepers." In the Punjab it has been observed that the districts affected with leprosy are those inhabited by carrion-eating castes, and it is suggested that the use of decomposed animal food—fish or flesh—may be the cause of the disease; but we cannot overlook the

fact that the Brahmin, who eats no animal food of any kind, is not exempt from the disease.[1]

Diabetes is said to be frequently seen among the rich elderly natives of Calcutta and Bombay; to what extent it affects the other classes is unknown.

Goitre is endemic in the valleys of the Himalayas, and in the Tarai and the Brahmaputra valley, situated at their base. In some localities goitre and cretinism coexist; in others, where goitre is common, cretinism is unknown. Dr. Coats makes the interesting observation that at Chumparun, a district where goitre is very common, goats, sheep, dogs, and horses suffer from the same or an analogous disease. It is common at Secrora, and in that part of Oudh situated between the Gogra and Nepal.[2]

The hill districts of Orissa and Chota Nagpur form another region of endemic goitre, cretinism being also met with in some of the goitrous localities.

In Burma, goitre is unknown in Arakan, and is practically so in Pegu, but a considerable number of cases are met with in the Irawadi and Tenasserim divisions.

Cancer.—Hard cancer is rare in Lower Bengal, but epithelioma is of more frequent occurrence. Nor does cancer seem to be a common disease on the Deccan table-land. At Hyderabad, out of 2657 operations performed in the Afzul Gunj Hospital in 1886, only two were for malignant disease. In Bombay the deaths registered from cancer in 1875 formed only 0·1 per 1000 of the total deaths, as against the English ratio of 28 per 1000. In Kashmir, on the other hand, epithelioma is excessively common. Elmslie met with 30 cases at Sirinagar out of 5080 patients treated. He ascribes the frequency of the disease in Kashmir to the habit which the natives have of carrying a kind of earthen pot with live charcoal, in cold weather, in proximity to the skin, under their loose dresses.

Beriberi.—The area within which beriberi is endemic in India is a somewhat limited one, being confined to certain districts of the Madras Presidency. The disease, however, is not restricted to limits that admit of being accurately defined, although the foci of its greatest prevalence are to be found along the east coast, from the Mahanuddy to the Pennair, and inland as far as Kamptee in the Central Provinces, Secunderabad in the Nizam's Dominions, and Bellary in Mysore. It is not entirely unknown on the south-east and south-west coasts of Madras.

[1] It is observed that leprosy in Assam is chiefly found amongst the coolies introduced from other parts of India to cultivate the tea-gardens.

[2] Greenhow, *Ind. Ann. Med. Science.*

In 1881, out of a strength of 28,533 native troops belonging to the Madras command, there were 20 deaths from beriberi, or a ratio of 0·7 per 1000 of the mean strength. In 1883 no fewer than 31 cases of beriberi, 5 of which proved fatal, occurred in the 9th Native Infantry stationed at Secunderabad. These facts show that the disease is by no means rare or free from danger, and illustrates its tendency to attack, in force, certain bodies of men living together.

The following table, from Malcolmston, shows the influence of season on the prevalence of the disease in India:—

Hot Season.		Rainy Season.		Cold Season.	
March,	19	July,	34	November,	99
April,	27	August,	68	December,	54
May,	13	September,	99	January,	25
June,	27	October,	90	February,	17
	86		291		195

A disease which broke out in Assam and Lower Bengal in 1877–80, and which is referred to by Hirsch, was not true beriberi, but a specific contagious disease, which I have elsewhere described as "Acute Anæmic Dropsy," and which was imported into Mauritius by coolies from Calcutta.

CHAPTER XXII.

CEYLON.

Geographical.—Ceylon consists of a central mountain zone, placed nearer to the southern than to the northern part of the island, attaining an elevation of from 6000 to 8000 feet. The table-land of Nuwara Eliya, which serves as a sanatorium, is about 6200 feet above the sea-level; while Kandy, the capital of the Central Province, has an altitude of 1665 feet. This mountainous district covers about one-fifth of the island, the other four-fifths consist of flat or undulating plains. Spurs from the central hills radiate only for a short distance, with the exception of those that stretch towards Trincomalee on the north-east. The formation of the island is mainly gneiss, broken up here and there by granite. The soil is composed in great part of disintegrated gneiss, of alluvium carried down from the high lands, and, near the shore, of marine deposits. Along the southern and western coasts laterite prevails; on the northern coast coral formation is common; while at Jaffna the soil contains much iron, which imparts to it a red colour. On the north-west, low sandy plains stretch inland from the shore. The soil of the plains of Nuwara Kalaw and the Wanny consists of a vegetable mould, which was formerly rendered productive by means of enormous tanks, some of which were ten or fifteen miles in circumference; these tanks have been allowed to fall into ruin. The population, which must formerly have been dense, has now become sparse; and the rains and streams being allowed to run to waste, this region has become extremely malarious.

The most important river is the Mahavila Ganga, which rises in the central knot, and runs to the north, to fall into the sea at Trincomalee. The Kelani falls into the sea on the west coast at Colombo. On the same coast are the Kalu Ganga, the Dedra Oya, the Kala Oya, the Malwatta Oya, and other streams of smaller size. Falling into the sea on the south coast are the Wallaway Oya, the Mahagam Oya, the Kumbukgam Aar, and along the north and north-west shores are a few streams of small size. In the rainy

season some of these rivers overflow the country through which they run.

The island is divided into seven provinces, having, in 1885, the population assigned to them in the following table:—

Province.	Population.
Western,	929,856
North-Western,	290,277
Central,	640,999
North-Central,	65,088
Northern,	315,104
Eastern,	132,651
Southern,	454,179
Total,	2,828,154

VITAL STATISTICS.—The birth and death rates vary widely according as the season is healthy or otherwise. The range of fluctuation may be gathered from the rates for the two consecutive years 1884 and 1885, the former of which was a healthy year, and the latter one when fever was epidemic.

	Birth-Rate.	Death-Rate.
1884,	31·3	22·4
1885,	28·3	29·3

The marriage-rate from 1867 to 1876 is given at 14·6 per 1000, and the death-rate, for the same period, at 21·6. These figures must be taken with a certain reserve.

CLIMATOLOGY.—The average mean temperature of Colombo on the coast is 80°·7 F.; that of Kandy, at an elevation of 1650 feet, 75°·4 F.; and that of Nuwara Eliya, which is situated 6240 feet above the sea-level, 57°·6 F. The mean daily range varies from 22°·2 F. at Colombo to 34°·4 F. at Anurádhapura in the North-Central Province. The average rainfall of Jaffna, in the north of the island, is 27·3 inches; of Trincomalee, on the east coast, 69·60 inches; of Galle, on the south-west coast, 107·16 inches; of Colombo, on the west coast, 87·62 inches.

The following tables give (1) the monthly mean temperature of Colombo, of Kandy, and of Nuwara Eliya, showing the effect of elevation on the temperature. (2) The average monthly rainfall of Colombo on the west coast, of Trincomalee on the east coast, and of Anurádhapura in the North-Central Province, at an elevation of 312 feet:—

MEAN MONTHLY TEMPERATURE.

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Colombo,	79·0	80·1	82·0	82·5	82·5	81·0	80·6	80·5	80·7	80·2	79·8	79·0
Kandy,	73·2	74·8	77·5	77·9	77·9	75·5	75·0	75·1	75·0	74·7	74·3	73·6
Nuwara Eliya,	56·5	57·1	58·7	59·4	60·1	57·5	56·5	56·8	57·2	57·5	57·5	56·8

AVERAGE MONTHLY RAINFALL.

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Colombo, ...	3·01	1·74	5·27	9·58	13·29	8·13	5·23	4·46	4·68	12·89	12·37	6·97
Trincomalee, . . .	8·01	3·71	1·23	2·55	2·46	0·48	2·88	2·68	5·74	7·82	13·27	9·42
Anurádhapura, . .	3·57	2·52	2·01	8·26	2·92	0·97	0·04	3·26	4·00	3·54	11·15	5·98

On the east coast the north-east monsoon supplies the greater part of the rainfall, the rainy season being from October to December. The south and west coasts receive the south-west monsoon from May to October. The influence of the north-east is more general than that of the south-west monsoon.

The rainfall in the inland parts of the Eastern Province is insufficient for cultivation, and for this reason the population is here chiefly confined to the banks of the rivers and streams, where irrigation can be practised.

PATHOLOGY.—*Malaria* is widely prevalent among the native population. In the healthy year 1884 the deaths ascribed to fevers of all kinds were 4·73 per 1000 living; while in 1885, a year when malaria was epidemic, the ratio rose to 7·61 per 1000. Although these figures refer to all fevers, yet they serve to give an approximate idea of the mortality from malarial fevers, as will be seen by the following statement of the forms of fever treated in the District Civil Hospitals in 1885 and 1886, and the deaths from each form:—

	1885.		1886.	
	Admissions.	Deaths.	Admissions.	Deaths.
Enteric Fever, ...	51	21	48	20
Simple Continued Fever, . .	153	14	251	13
Febricula, ...	32	0	3	0
Ague, ...	3465	19	2725	26
Remittent Fever, . . .	145	32	161	23

The deaths in hospital from enteric fever form about one-fourth of the total fever deaths; but the deaths from this form of fever in the general community will be in a much smaller ratio, as a large proportion of the deaths from malarial fever occur in children, who are seldom treated in hospital, while enteric fever is most common at those ages which furnish the greatest number of inmates to hospital.

The white troops stationed in Ceylon suffer comparatively little at the present day from malarial fever, the ratio of admissions for the five years ending 1888 having been 43·2 per 1000. Extensively prevalent as malaria is in Ceylon, it is much less diffused than in most parts of India.

From the subjoined table, founded upon the returns of 1885, it will be seen that the individual provinces differ greatly from each other as respects their liability to malarial fever :—

Provinces.	Ratio of Fever Deaths per 1000 living.	Provinces.	Ratio of Fever Deaths per 1000 living.
Western, . . .	3·71	Northern, . . .	12·65
North-Western, . .	15·50	Eastern, . . .	12·88
Central, ...	6·68	Southern, . . .	5·80
North-Central, . .	14·45		

The Western, Central, and Southern Provinces are the healthiest; the most malarious are the North-Western and the North-Central, but the Northern and Eastern are also severely affected. It would appear that those regions where the population is comparatively sparse, where there exist extensive plains not admitting of ready drainage, and where rains and droughts alternate, are those most subject to malaria. The disease is less severe along the seashore than at some distance inland. It is the belt of land stretching along the base of the first range of hills, and the low valleys between these ranges, that are most malarious. When we reach a height of 2000 feet malarial fever becomes comparatively rare. Even at Kandy, at a lesser elevation, the population appear healthy, and malarious diseases are neither common nor severe.

Coming now to the seasonal prevalence of malarial fevers, it will be seen that their period of maximum frequency is not the same throughout the island, but is influenced to a considerable extent by the distribution of the rainfall.

The following tables, for which I am indebted to Dr. Kynsey, are intended to illustrate the seasonal distribution of malarial fever for five years (1883–87), and, for the sake of convenience, dysentery is included, although the figures for this disease are only given for the three years 1883, 1884, and 1885 :—

WESTERN PROVINCE.

	1883.			1884.			1885.			1886.			1887.		
	Rainfall.	Fever Mortality.	Dysentery Mortality.	Rainfall.	Fever Mortality.	Dysentery Mortality.	Rainfall.	Fever Mortality.	Dysentery Mortality.	Rainfall.	Fever Mortality.	Dysentery Mortality.	Rainfall.	Fever Mortality.	Dysentery Mortality.
1st Quarter	16·19	352	395	14·61	343	312	16·33	805	418	10·93	640	..	7·01	567	..
2nd ,,	48·73	283	266	29·49	442	253	88·78	1078	422	45·25	659	..	57·81	2279	..
3rd ,,	33·93	335	411	19·85	618	251	30·65	998	537	36·06	640	..	16·13	1817	..
4th ,,	37·24	296	417	45·51	419	282	45·56	571	445	23·32	611	..	34·14	816	..

North-Western Province.

	1883.			1884.			1885.			1886.			1887.		
	Rainfall.	Fever Mortality.	Dysentery Mortality.	Rainfall.	Fever Mortality.	Dysentery Mortality.	Rainfall.	Fever Mortality.	Dysentery Mortality.	Rainfall.	Fever Mortality.	Dysentery Mortality.	Rainfall.	Fever Mortality.	Dysentery Mortality.
1st Quarter	4·15	619	82	2·92	565	82	3·49	1931	276	5·24	639	..	3·07	513	..
2nd ,,	16·46	550	90	9·71	762	81	7·50	1044	251	11·06	606	..	10·29	727	..
3rd ,,	1·61	531	77	0·50	1280	134	5·01	852	161	5·75	502	..	0·57	1078	..
4th ,,	19·19	496	69	28·49	970	142	39·32	674	119	16·84	468	..	40·29	584	..

Central Province.

	1883.			1884.			1885.			1886.			1887.		
	Rainfall.	Fever Mortality.	Dysentery Mortality.	Rainfall.	Fever Mortality.	Dysentery Mortality.	Rainfall.	Fever Mortality.	Dysentery Mortality.	Rainfall.	Fever Mortality.	Dysentery Mortality.	Rainfall.	Fever Mortality.	Dysentery Mortality.
1st Quarter	15·20	357	449	8·67	306	457	8·34	1676	943	14·77	246	..	8·07	193	..
2nd ,,	26·58	318	494	13·81	379	485	26·08	1024	686	22·96	199	..	20·66	188	..
3rd ,,	22·04	396	478	16·48	1230	627	18·31	904	736	27·80	262	..	13·88	257	..
4th ,,	27·03	411	480	40·59	1161	802	34·22	682	627	22·86	220	..	51·91	258	..

North-Central Province.

	1883.			1884.			1885.			1886.			1887.		
	Rainfall.	Fever Mortality.	Dysentery Mortality.	Rainfall.	Fever Mortality.	Dysentery Mortality.	Rainfall.	Fever Mortality.	Dysentery Mortality.	Rainfall.	Fever Mortality.	Dysentery Mortality.	Rainfall.	Fever Mortality.	Dysentery Mortality.
1st Quarter	17·14	59	50	1·13	112	53	5·92	659	189	2·90	114	..	5·79	101	..
2nd ,,	17·23	74	40	10·87	69	61	25·66	130	120	14·35	81	..	12·36	55	..
3rd ,,	5·31	49	32	4·23	69	72	4·51	91	74	13·53	64	..	0·29	78	..
4th ,,	36·85	49	30	39·16	253	93	43·56	61	75	15·73	77	..	48·57	61	..

Northern Province.

	1883.			1884.			1885.			1886.			1887.		
	Rainfall.	Fever Mortality.	Dysentery Mortality.	Rainfall.	Fever Mortality.	Dysentery Mortality.	Rainfall.	Fever Mortality.	Dysentery Mortality.	Rainfall.	Fever Mortality.	Dysentery Mortality.	Rainfall.	Fever Mortality.	Dysentery Mortality.
1st Quarter	10·09	457	75	0·68	915	54	1·31	1344	134	8·59	1708	..	4·67	655	..
2nd ,,	8·38	636	90	2·53	402	34	10·95	1000	87	6·23	837	..	4·47	443	..
3rd ,,	0·43	256	50	0·86	296	34	3·54	661	64	8·60	530	..	0·88	367	..
4th ,,	43·71	437	50	59·16	566	80	49·26	983	73	19·90	582	..	32·74	424	..

EASTERN PROVINCE.

	1883.			1884.			1885.			1886.			1887.		
	Rainfall.	Fever Mortality.	Dysentery Mortality.	Rainfall.	Fever Mortality.	Dysentery Mortality.	Rainfall.	Fever Mortality.	Dysentery Mortality.	Rainfall.	Fever Mortality.	Dysentery Mortality.	Rainfall.	Fever Mortality.	Dysentery Mortality.
1st Quarter	17·23	138	17	5·21	182	37	7·02	800	137	11·46	244	..	6·91	161	..
2nd ,,	8·51	217	31	4·04	128	18	3·59	507	66	6·46	183	..	5·09	194	..
3rd ,,	3·74	147	37	6·81	130	27	6·74	222	65	12·71	142	..	8·44	144	..
4th ,,	41·60	140	23	37·58	235	35	41·24	190	33	30·77	155	..	39·79	140	.

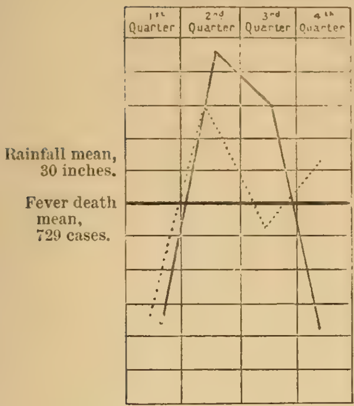
SOUTHERN PROVINCE.

	1883.			1884.			1885.			1886.			1887.		
	Rainfall.	Fever Mortality.	Dysentery Mortality.	Rainfall.	Fever Mortality.	Dysentery Mortality.	Rainfall.	Fever Mortality.	Dysentery Mortality.	Rainfall.	Fever Mortality.	Dysentery Mortality.	Rainfall.	Fever Mortality.	Dysentery Mortality.
1st Quarter	8·12	419	301	4·32	425	393	7·68	723	251	7·14	826	..	7·65	809	..
2nd ,,	18·40	364	240	13·12	343	314	17·27	630	194	24·21	707	..	16·36	521	..
3rd ,,	12·11	453	334	8·39	396	412	6·61	679	372	14·08	769	..	8·69	550	..
4th ,,	23·37	463	360	22·52	384	286	30·83	604	420	25·65	759	..	29·30	446	..

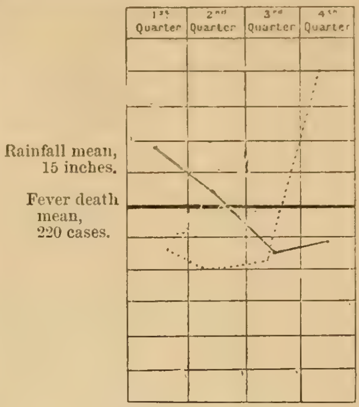
From these figures (allowance being made for epidemic influence) it appears that, in Ceylon, the effect of the heavy rains in May and June is to raise the fever mortality during the second and third quarters in those provinces which receive the full force of the south-west monsoon; whereas, instead of a rise, a fall takes place during these quarters in those provinces where May and June are dry months. The rise in the fever mortality, which sets in in December and continues high during January all over the island, tends to maintain itself longer in those provinces that are under the influence of the north-east monsoon; but the persistent dry weather at last tells, bringing the fever mortality below the mean from June to October, the period when it is above the mean, in those provinces in which the May and June rains are heavy. The quarterly distribution of fever mortality in relation to rainfall will be more easily understood by representing it graphically, thus:—

Western Province. Eastern Province.

Each thin line represents 5 inches of rainfall, and 50 fever deaths.



Rainfall, ... ; Fever deaths, ——



Rainfall, ... ; Fever deaths, ——

It is clear from this diagram that the fever period differs greatly on the two sides of the island; the only appreciable cause being the difference in the distribution of the rainfall on the two coasts. But it must be observed that the temperature of Ceylon is not only high throughout the year, but is remarkably uniform, so that there is little difference in this respect between winter and summer. Thus the summer may be said to be determined by the period of rainfall on the two coasts of the island. It is only in such circumstances that the fever period is materially regulated by the season of rainfall. In countries where the winters are cold, this changing of the fever period according to rainfall is not observed.

The year 1885 was one in which fever was unusually fatal all over the island. This epidemy, if such it may be called, had already begun in 1884 in all the provinces except the southern one. A study of the dates at which the fever mortality rose in the different places, suggests that the epidemy in this instance commenced in the north and spread southwards.

The most common form of fever in Ceylon is ague; the remittent type is the most fatal. The medical officer at Puttalam, in 1885, notices the prevalence in that district of fever, with enlarged spleen, anæmia, general dropsy, and diarrhœa, accompanied in some cases by epistaxis, melæna, hæmatemesis, and hæmorrhage from the gums and kidneys.

Dr. Vanderstraaten attributes an increase of fever in the district of Kalatura, in 1886, to the felling of jungle in the neighbourhood. The labourers employed in opening up tea estates are also specially liable to fever.

A cyclone, in 1884, submerged the greater part of the district of Pachchilappallai in the Northern Province. This district suffered much from fever in 1885.

In some instances an unusual prevalence of fever is referred to general insanitary conditions; in many instances no explanation of its epidemic extension is given.

Enteric Fever forms about 1·5 per cent. of the total fever admissions, but it occasions no less than 24 per cent. of the fever deaths occurring in hospital. The admission-rate among the European troops for the five years preceding 1888 was 5·6 per 1000, and the death-rate 3·13. In 1888 the ratios were 16·8 and 6·18 per 1000 respectively. In the *Army Medical Report* for that year it is stated that the prevalence of enteric fever in Ceylon has been understated in the annual returns, as the disease so frequently runs an irregular course in the island that the diagnosis is uncertain and difficult. In two of the fatal cases occurring in 1888 all the diagnostic symptoms are said to have been absent. From this it may be inferred that tropical typhoid, so common in India, is also known in Ceylon. The disease appears to be less frequent among the natives than among the European troops. It is most prevalent in Colombo and the large centres of population.

Typhus Fever is not met with in Ceylon.

Diphtheria, if it occurs at all, must be very rare, as no case of this nature is recorded in the returns of any of the Civil Hospitals during the year 1885, or for any of the years for which I have received returns. Nor does croup appear among the diseases treated in hospital. Twelve cases of laryngitis are returned out of 23,847 cases treated in 1885; but it is evident that these were neither diphtheria nor croup, from the fact that only one of the cases proved fatal. Croup, however, is not unknown in Ceylon, for we find 236 deaths returned from this disease in the Registrar-General's Report for 1885, which gives a ratio of 80, as against the English average of 170, per million.

Smallpox causes a moderate mortality every year, and occasionally appears in mild epidemics.

Scarlet Fever is not endemic in the island, but it has been observed to a small extent, and of a mild type, in Colombo. *Measles* is endemic, but not of a severe form. Only 50 deaths were registered from this disease in 1885.

Erysipelas forms about 2 per 1000 of the hospital admissions.

Dysentery takes the second place in the death-roll of Ceylon. In the healthy year 1884 the dysenteric death-rate was 2·09 per 1000. In the malarious year 1885 the ratio rose to 2·82. In order to appreciate the meaning of these figures, it must be borne in

mind that the mortality from dysentery in England is about 28 per million, in Ceylon it is above 2000 per million; in other words, it is nearly a hundred times as fatal in Ceylon as in England.

The incidence of dysentery on the different provinces in 1884 was as under:—

Province.	Dysenteric Death-rate per 1000.
Western,	1·18
North-Western,	1·49
Central,	3·68
North-Central,	4·18[1]
Northern,	0·64
Eastern,	0·88
Southern,	3·11

The distribution of dysentery will thus be seen to differ greatly from that of fever. In the Western Province, it is true, where fevers are less fatal, dysentery is by no means severe; but the Southern and Central Provinces, which are comparatively slightly affected with malaria, suffer greatly from dysentery. The Northern Province, again, is highly malarious, but dysentery here is rather rare.

The season of the year when dysentery attains its maximum varies so much in different years, that it is impossible to lay down any definite rule as to its relation to season, temperature, or rainfall.

Diarrhœa prevails to a considerable extent, but causes a small mortality compared with dysentery. The deaths ascribed to this disease in 1884 were in the ratio of 900 per million, against the English average of 652.

Cholera is not endemic in the island, but from its vicinity to India it suffers from frequent outbreaks of the disease.[2]

Phthisis gave rise to a mortality of 710 per million in 1884, but in the epidemic year 1885 the mortality was less. This is not to be regarded as indicating an antagonism between these diseases, but was probably owing to a certain proportion of the population having been carried off by fever who would otherwise have fallen victims to consumption.

Bronchitis.—We have not met with any accurate statement of the number of deaths from the individual diseases of the respiratory group in relation to the numbers living. In 1885 only 151 deaths were ascribed to bronchitis, 185 to asthma, 232 to pneumonia, 317 to pleurisy, and 281 to unspecified lung disease. This gives, on the

[1] The death-rate from dysentery in the North-Central Province was unusually high this year.

[2] In the *Administration Report* (*Medical*), 1885, instances are related which point to the diffusion of cholera by human intercourse. We find it also stated that in previous epidemies the disease reappeared when the inmates returned to their house after an absence of several days or weeks; but that on this occasion, when the houses were disinfected, no fresh cases appeared in any house. This shows that the germs of the disease may retain their vitality in a house for some weeks, unless it is disinfected.

population of that year, a total death-rate of 412 per million. Respiratory diseases gave rise in England, in 1884, to 3325 deaths per million living, whilst in Ceylon the ratio in the same year was 312·3 per million. This group, as a whole, is thus, making all allowance for the inaccuracies of the returns, very much more fatal in England than in Ceylon. In 1888 the respiratory group of diseases caused 63·2 admissions among the soldiers in the United Kingdom; in Ceylon the ratio was 21·2. The difference as respects the frequency and fatality of respiratory diseases in the two countries is mainly caused by the much smaller bronchitic death and admission rates in Ceylon. Bronchitis forms from 1·5 to 2·2 per cent. of the admissions, and from 0·8 to 1·2 per cent. of the deaths, in the Civil Hospitals, the proportion of deaths to admissions being 1 in 21·3 (estimated upon the two years 1885 and 1888); whilst, according to Lombard, the deaths in Geneva are 42 in 673 patients, which is in the proportion of 1 death in 15·2 treated for the disease. The admission-rate for bronchitis among the European troops stationed in Ceylon varies from 20 to 30 per 1000, but the disease is rarely fatal.

Respecting the comparative rarity and mildness of bronchitis there can be no doubt; but it is not so easy to arrive at a fair estimate of the prevalence of pneumonia. The pneumonia admissions into the Civil Hospitals form only from 2 to 3 per cent. of the total, but the deaths from this disease form from 5 to 12 per cent. of the total deaths. In the years 1885 and 1888 the deaths to the cases were in the ratio of 36·6 per cent. Upon the whole, I judge that pneumonia is considerably less frequent, but no less severe, in Ceylon than in England.

Pleurisy is rare, but we have no data for estimating its comparative prevalence, except that it causes about 2 per 1000 of the admissions, and from 2 to 3·5 per 1000 of the hospital deaths.

Whooping Cough appears in an epidemic form from time to time.

General Dropsy is a fatal disease in Ceylon, and is doubtless in most instances a result of the malarial infection.

Dr. Kynsey[1] has drawn attention to the prevalence of the *Anchylostoma duodenale* in Ceylon. It is met with "wherever there are accumulations of fæces on moist uneven ground containing water, in localities occupied by men and animals where there are no latrines, or badly constructed ones," and these conditions prevail extensively in Ceylon. This parasite causes marked anæmia and dropsy, and sometimes induces diarrhœa and intestinal hæmorrhage. We can easily understand that a part of the mortality from dropsy is due to anchylostomiasis. The death-rate from general dropsy in

[1] *Report on Anæmia or Beriberi of Ceylon*, Colombo 1887.

Ceylon is 250 per million, while in England the ratio is 32 per million. Dr. Kynsey considers that much of what is called beri-beri is really due to this parasite.

Rheumatism, according to the returns, gives rise to about 130 deaths per million living,—a ratio almost identical with that of England. Judging from the admission-rate among the troops, the disease is considerably less frequent than in England.

Leprosy is met with in all parts of the island, both along the coast and inland. It appears, however, to be more frequently observed on the coast. A considerable number of cases occur in the inland districts of Ratnapura and Kurunégala. The number treated in the Leper Asylum of the colony in 1885 was 209; but this must represent a small proportion of the total number of lepers in the island. It is believed, however, that it is not increasing at the present day.

Syphilis in its primary form gives rise to fewer admissions among the troops than in the United Kingdom; but secondary forms are, on the other hand, as frequent in Ceylon as at home, perhaps more so.

The *Parangi* disease, characterised by eruptions and ulcerations of the skin and affections of the bones and joints, is believed to be identical with framboesia or yaws, and is benefited by antisyphilitic treatment. It gave rise to 792 out of 23,283 admissions in 1888, and of these 8 died. It is particularly prevalent in the district of Kurunégala in the North-West Province.

Scrofula is rather frequently met with in all parts of the island. It furnished 73 admissions and caused 4 deaths in 1888 in the hospitals.

Rickets ranks next to convulsions as the most fatal disease of infancy in Ceylon. In 1885 the deaths from this disease numbered 4145,[1] which gives a ratio of 1·46 per 1000 living, or 1460 per million, as against the English average of 22 per million. I cannot help thinking that some mistake has crept into the returns, or that the term "rickets" is used in Ceylon in a different sense from that in which it is employed in England; and some such explanation is all the more probable, that rickets is reported to be a rare disease in India. I have not met with any reference to such an extraordinary prevalence of the disease as these figures would indicate, in authorities treating of the diseases of the island.

Diabetes is met with chiefly in Colombo, but some of the cases are probably of a temporary character and of malarial origin.

Convulsions are exceedingly fatal, causing a mortality of about 1·40 per 1000 living. When we remember how frequently malaria induces convulsions in children, we will understand the frequency of this disease in Ceylon.

[1] *Administration Reports* (*Medical*), 1885, p. 122 D.

CHAPTER XXIII.

THE ANDAMAN AND NICOBAR ISLANDS.

THE Andaman and Nicobar groups, in the Bay of Bengal, are occupied as penal settlements. The only one of the Andamans which is not malarious is Ross Island. Surgeon-Major Reid gives an interesting account of an outbreak of fever among the convicts engaged on the reclamation of a mangrove swamp in 1881.[1] For years before this work was begun, Viper Island had been remarkably healthy and free from fever. The results of this reclamation work on the health of those employed on it will be seen from the following table. The meteorological observations were taken at Port Blair:—

Months.	Average Mean Temperature.	Mean Daily Range.	Rainfall 1881.	Number of Fever Cases admitted in 1881.	
				Viper Island Hospital.	All other Hospitals.
January, . .	79·0	10·6	2·13	87	730
February, . .	79·5	14·2	0·18	72	599
March, . . .	81·5	14·9	3·29	51	754
April, . . .	83·3	15·2	0·00	45	726
May, ...	81·3	10·2	18·47	204 [2]	841
June, ...	80·8	8·8	22·20	207	1093
July, ...	80·2	7·3	7·49	284	1169
August, . . .	79·8	8·6	9·34	190	807
September, . .	79·2	8·4	28·18	247 [3]	871
October, . . .	79·6	10·1	9·65	217	957
November, . .	80·1	9·7	15·27	352 [4]	924
December, . .	79·2	9·3	9·36	192	893

As the admissions at Viper Island Hospital were doubtless determined by the works going on, we have to look to the admissions

[1] *S.M.I.* 1881, p. 77.
[2] Reclamation work begun. First bund started.
[3] Second bund started.
[4] Rainfall 15·27 inches, as against an average of 8·14 inches.

into the other hospitals as indicating the relations of fever prevalence to rainfall and temperature in these islands. Fever is most common in June and July, when the rainfall is heavy, the temperature a little below the maximum, and the daily range at its lowest.

Dr. Reid notices the improvement effected at two of the stations in this group, by converting rice grounds into properly-drained meadows, laid out in grass, and planted at proper intervals with cocoa-nut trees.

Typhoid fever is almost unknown.[1]

Cholera has seldom visited the Andaman group, although it is in constant communication with the mainland,—a fact which has been advanced to prove that this disease is not transportable by intercourse with infected localities. But it should not be forgotten that, on one occasion at least, when it did appear in these islands, it was clearly traced to importation.

The natives of the Andaman Islands, according to Hodder (*Army Medical Report*, 1875), are short-lived, few reaching the age of 40 years. They suffer from fever, bowel complaints, and lung diseases.

[1] *Edin. Med. and Surg.* July 1890.

CHAPTER XXIV.

BURMA.

Geography and Climate.—Burma stretches from the confines of Tibet and China on the north, southwards into the Malayan Peninsula in 10° N. lat. It has thus a length of above 1000 miles, and an extreme breadth of about 700 miles. Its area is estimated at about 280,000 square miles, with a population, comprising Burmans, Shans, Karens, and Chinese, of nearly 10,000,000.

The greater part of Upper Burma is hilly and broken, being penetrated by spurs from the Patkoi and other ranges, which divide it from Tibet and China. Four principal parallel ranges running from north to south define the valleys of the Irawadi, the Sit-Taung, and the Salween rivers.

The principal river is the Irawadi, which, rising in Tibet, runs through Upper Burma, and begins to form its delta about the 18th degree, opening into the sea along the coast line between Rangoon and Bassein, covering an area of 10,000 square miles, much of which is forest. To the west of the Irawadi, and separated from it by the Arakan Yoma range, is the Kaladyne or Kaladan river, which rises in the Assam Hills, and forms a considerable delta, extending from Akyab eastward for 50 miles.

In the Arakan Division of Lower Burma, the mean annual rainfall is 188 inches. At Rangoon the fall is about 100 inches, and it is only somewhat higher at Bassein. The coast of Tenasserim has an annual fall varying from 173 at Mergui to 203 inches at Tavoy.

In the interior the rainfall is much less. At Prome it averages about 47 inches; at Thayetmyo, 40 inches; and at Mandalay about 45 inches. The rainy season lasts from May to September, the dry season from December to April. From February to May the climate along the coast is dry and hot, but the nights are fairly cool. In the interior, at Thayetmyo and Mandalay, the months of December, January, and February are comparatively cool, especially at night, but the summers are hot and oppressive.

Lower Burma, the only part respecting which we have any accurate information, is divided, for administrative purposes, into four divisions, viz. Arakan, Pegu, Irawadi, and Tenasserim, having a total population of 3,653,629. The only two towns of importance are Rangoon (134,176) and Moulmein (53,107). Mandalay, the capital of Upper Burma, has about 60,000 inhabitants.

We have already had occasion to refer to many points in connection with the pathology of Burma while treating of India. It will suffice to refer to some of the principal diseases of the country.

Pathology.—*Malaria.*—Lower Burma is not as a whole excessively malarious, comparing it with India. No great reliance, perhaps, can be placed on returns of the civil population. Yet the ratio of 8·3 per 1000 for the eleven years 1877–88 may be accepted as showing that malaria, as manifested by fever, causes fewer deaths in Burma than in India generally. The comparative freedom from malaria of Lower Burma is also shown, and more conclusively, by the experience of the troops stationed principally at Rangoon and Thayetmyo. The following are the admissions and deaths per 1000 for the six years 1881–86:—

	Admissions.	Deaths.		Admissions.	Deaths.
1881, . .	162·88	0·38	1884, . .	83·70	0·0
1882, . .	88·40	0·53	1885, . .	104·24	0·49
1883, . .	46·23	0·49	1886, . .	450·00	4·07

Excluding the year 1886, when the admission and death rates were swelled by military operations, the average admission-rate for the five years 1881–85 was 97·1, and the death-rate 0·38.

The admission-rate for malarial fevers in the Madras command, which is the healthiest one, and of which Burma forms a part, for the ten years 1870–79, was 166 per 1000, and the death-rate for the same period 0·62 per 1000. While Burma is thus by no means free from malaria, it compares favourably in this respect with other parts of India.

Malarial fevers form about one-sixth of the total cases treated in the dispensaries.

The Arakan Division is that in which malarial fever is most prevalent; Tenasserim is that which suffers least. Our experience in Upper Burma is not sufficient to enable us to judge of the extent to which it suffers from malaria. The fatigues of war always augment the admissions and deaths from this class of diseases; but so far as can be judged by the returns before us, malarial fever is more prevalent and fatal in Upper than in Lower Burma. In 1888 the admission and death rates in the Myingyan and Mandalay districts were 960·67 and 12·93 per 1000 respectively.

Fever in Burma attains its maximum mortality in August and September. It will be observed that the fever maximum here is in advance of that in Bengal and the North-West Provinces. The maximum mean temperature, which here is reached in April, is also in advance of Bengal.

Enteric Fever is endemic both on the coast and inland. Cases of the disease have been observed among the men of the ships of war visiting Rangoon.[1] It also appears to be met with in Mandalay, Myingyan, and Bhamo. The disease here is most common in the second quarter.

Bowel Complaints are prevalent in the towns, but much less so in the country districts; in the former the death-rate among the civil population 1880–84 was 2·74, and in the latter 0·73 per 1000. Dysentery and diarrhœa form a higher proportion of the total treated in the dispensaries of Burma than in those of Madras or Bombay. The admission and death rates in Lower Burma among the British troops for the six years 1881–86 were as follows:—

	Admissions.	Deaths.		Admissions.	Deaths.
1881, . .	33·71	0·76	1884, . .	59·31	1·11
1882, . .	97·94	1·06	1885, . .	56·99	0·48
1883, . .	67·39	0·98	1886, . .	116·28	6·41

Omitting the year 1886, the average admission-rate was thus 63·07 and the death-rate 0·88 per 1000, as compared with those of the army of India (1881–84), which were 29·0 and 0·76 respectively. Dysentery is common in Myingyan and Mandalay in Upper Burma. It follows that dysentery and diarrhœa are more frequent and fatal in Burma than in India.

Chest Affection, *Bronchitis*, and *Pneumonia* are moderately prevalent in Burma. *Phthisis* appears to be rather rare in Lower Burma; as regards Upper Burma, I have no information.

Beriberi is met with in Lower Burma, but I have not been able to ascertain to what extent it prevails, nor have I found any evidence bearing upon the question whether it was first introduced there by the British troops in 1824, as has been affirmed. A severe outbreak of the disease occurred in the jail at Mandalay about 500 miles up country in the year 1887. In this instance no *anchylostoma duodenale* were found in the fatal cases.

[1] *Statist. Report, Navy*, 1887.

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